DOCUMENT RESUME

ED 411 464 CE 074 813

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TITLE Observations regarding the Development of Occupational/Skill Clusters.
INSTITUTION Institute for Educational Leadership, Washington, DC.
SPONS AGENCY Department of Labor, Washington, DC.
PUB DATE 1994-04-28
NOTE 58p.; A commissioned paper to advise the National Skill Standards Board and the Skill Standards Developmental Process.
PUB TYPE Opinion Papers (120)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Education Work Relationship; Educational Needs; Futures (of Society); *Job Skills; *Job Training; *Occupational Clusters; Postsecondary Education; Program Development; Program Effectiveness; Program Implementation; Program Improvement; *Standards; Workplace Literacy
IDENTIFIERS *Vocational Technical Education Consortium States

ABSTRACT

This paper presents an overview and suggestions about the development of occupational and skill clusters by the Vocational-Technical Education Consortium of States (V-TECS), based on the observations of the executive director of the organization. Aspects reviewed include the following: development of occupational and skill clusters; classification systems; models; perceptions of the vocational-technical education environment regarding occupational and skills clusters; selecting processes; role-players in the process of setting and using skill standards; and the role of V-TECS. Some conclusions and recommendations are the following: (1) outcomes need to become more consistent; (2) the National Skill Standards Board should develop simple operational definitions for the major terms it intends to use; (3) it is difficult to implement national models in a country with a heterogeneous work force; (4) more attention should be given to the small business sector where most of the new jobs are being created; and (5) although business and industry representatives talk about generalized work behaviors and workplace literacy, they want customized training. Two appendixes include a skills matrix and an example of the V-TECS process. (KC)

OBSERVATIONS REGARDING THE DEVELOPMENT OF OCCUPATIONAL/SKILL CLUSTERS

An
Institute for Educational Leadership
U. S. Department of Labor
Commissioned Paper
to
Advise the National Skill Standards Board
and the
Skill Standards Developmental Process

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April 28, 1994

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ABOUT THE AUTHOR

The observations in this commissioned paper regarding the development of occupational/skills clusters are from the perspective of the Executive Director of the Vocational-Technical Education Consortium of States, a non-profit organization that has been conducting occupational analysis, task analysis, performance based instructional analysis, and criterion-referenced assessment development using incumbent workers and their supervisors for nearly twenty-one years . In this capacity he works directly with twenty-three states and indirectly with every state in the nation as well as with six federal agencies including the technical commands of the Army, Navy, Air Force, and Marine Corps. His organization has hosted over forty visits from thirty different countries at the request of the International Labor Affairs element of the U.S. Department of Labor (DOL) and the World Bank. His organization is conducting the Heating, Air Conditioning and Refrigeration National Skill Standards Project for the U.S. Department of Education. Prior to his arrival at V-TECS in 1980, he served as Director of Research and Development for the Department of Adult, Vocational and Technical Education, Illinois State Board of Education. In this capacity he ran a five million dollar per year research, curriculum development, exemplary programs professional development, and sex equity function. Prior to that he taught at the secondary and university level and served as a job placement coordinator in an adult school in a depressed community.

He has served on numerous advisory groups to include the Board of Directors of the American Vocational Association where he served as Chair for the Legislative Committee during the reauthorization of Carl Perkins. Paralleling these experiences, Dr. McCage served for twenty-eight years as an officer in the United States Army Reserve (USAR). Over half of his time in the USAR was spent in Reserve Forces Schools where he was a Military Occupational Specialist, Branch Officers Advanced Course and Command and General Staff Instructor as well as the Director of Officer Courses and an Assistant Commandant for the Chamblee, Georgia, USARF School which serves the Northern half of the State of Georgia.

GENERAL OBSERVATIONS REGARDING THE DEVELOPMENT OF OCCUPATIONAL/SKILL CLUSTERS

Background Paper Questions

The first step taken in writing this paper was to carefully review the background paper that was provided by Joan Wills as well as several of its references to better grasp the primary issues and questions that should be addressed in this paper. As a consequence, the following questions were selected as being the most critical to this discussion. While the reader may not find specific sections that address each of these questions independently, the balance of the paper will focus on addressing the following:

A. What is an Occupational/Skill Cluster? What criteria should be used in defining clusters?

- How do occupations relate to one another?
- How might they be clustered for purposes of skill standards development either now or in the future?

B. What Occupations/Occupational Clusters result form the identified skill clusters?

- What existing classification system should be examined and what does each have to offer to this enterprise?
- What should be the relationship between the occupational/skill clusters and the occupational analysis system that will redefine the DOT?
- What number of occupational/skill clusters will insure transferability across occupations 10-20? 200-300?

C. What methodology might be used in addressing Question B?

- Should occupational clusters be developed based on worker oriented or job-oriented traits?

Goals 2000 Implications

To place these questions in context, the National Skill Standards Board Title of the Goals 2000 legislation was reviewed for congruence. The following points were extracted from the legislation as being the most critical to this discussion.

Section 502 of Title V spells out the purpose of the Board as follows:

> It is the purpose of this title to establish a National Skill Standards Board to serve as a catalyst in stimulating the development and adoption of a voluntary national system of skill standards and of assessment and certification of attainment of skill standards --
>
> (1) that will serve as a cornerstone of the national strategy to enhance workforce skills;
>
> (2) that will result in increased productivity, economic growth and American economic competitiveness; and
>
> (3) that can be used in connection with civil rights laws --

Section 504 of Title V spells out the functions of the Board as follows:

> ... the National Board shall identify broad clusters of major occupations that involve one (1) or more than one industry in the United States that share characteristics that are appropriate for the development of common skill standards.

To achieve this task, Congress set a deadline of December 31, 1995, for the National Skill Standard Board to identify those occupational clusters pursuant to Section 504(a) that would represent a substantial portion of the workforce for which the initial sets of skill standards for the clusters identified would be developed.

Section 508 defines the term skill standard as "a standard that specifies the level of knowledge and competence required to successfully perform work related functions within an occupational cluster."

To those of us who have spent several years doing this type of work virtually every word in this definition has real meaning in terms of providing clarity to the task at hand. Under this definition skills become a derivative of the process of analyzing occupations which means there are at least two levels in the hierarchy of clusters within occupations, occupational families or industrial families. What this Law requires is that we look at occupations that group together based on their common characteristics or skills as opposed to trying to create artificial groupings of skill clusters that have little meaning out of the context of their application.

The Importance of Being Accurate

Certain assumptions inferred or presented as fact in the background paper simply don't hold water out where the rubber meets the road. One such assumption is that all occupations can be reduced to some 17-20 occupational skill clusters in which people can be taught and certified as being competent workers. The facts are that all occupations can be easily grouped into about 8 - 16 occupational or industrial families but to assume that meaningful instruction, training, and work related skill certification can occur at this level is pure folly. Meaningful education and training that will result in the certification of work based skills, do not begin to emerge until you reach the second or third tier of a given occupational classification structure. The best you can produce at this broad occupational field or industrial level is a very broad

based generalized curriculum that does nothing more than introduce an occupation or industry at its broadest descriptive level. At this level broad based generalizable skill statements are so far away from where they are applied they are meaningless. This is especially true when assessment and certification of competence is introduced into the equation as required in the 22 skill standards projects and as inferred in the School-to-Work Opportunities Act. Meaningful assessment and certification of work based competence cannot occur until one can clearly define an occupation in terms of what one has to know and be able to do in the context of that occupation or occupational cluster. If there is one thing learned from over twenty years of experience in this business, it is that functions, duties, tasks, and skills have little meaning unless they are treated in the context of a given application and that application is normally a group of jobs or occupations that are closely related. Without this rationale, meaningful analysis, research, and documentation cannot be provided with any degree of accuracy, reliability, or validity given the requirements of the American Disabilities Act as well as all other applicable civil rights statutes. This is why business and industry is currently spending very large sums of money to define their internal jobs and positions using an occupational or functional analysis process.

Several issues regarding skill standards need to be clarified so that the outcomes will become more consistent over time. Most of the current confusion surrounding the skill standards projects has been caused by the speed with which the national skills standards concept has moved from a sleepy little set of thirteen developmental projects funded some twenty months ago to a national movement with its own board and legislation. What started as a group of projects originally designed to experiment with several different approaches to the development of voluntary skill standards has rapidly become a set of 22 projects whose outcomes must look somewhat alike and be transportable across all projects. This writer doesn't feel the same urgency for each project to conform to a set model or models at this point in the process since there is still plenty of time to deal with the issue of transferability of skills. At this point in the process much more can be learned from the varied experiences that each project is having than can be learned from forcing each project to follow the same model this early in the process. We must realize that the skill standards effort is a long and complex challenge and must be treated as such. This writer feels that at this point in time it is more important to satisfy the stakeholders in each occupation or industry than it is to try to ascertain which skills cut across all projects or all occupations. Satisfaction of the primary stakeholders is the key to sustaining these efforts long term.

Consequently, the first thing the Skill Standards Board should do is to arrive at some very simple operational definitions for the major terms it intends to use. For example, when the term "industry-wide" is used, one group of people will think of the construction industry, the electronics industry, or the manufacturing industry while another group will think of the residential construction industry or the commercial construction industry. To others residential or commercial construction are occupations or jobs while to others, occupations or jobs are roofer, painter, framer, etc. In arriving at definitions, one thing is certain. You'll never find a set of definitions that everyone will agree to, so don't worry about it. What is important is that the organization calling the shots has its own operational definitions for the conduct of its own dialog. Once the National Skill Standards Board systematically determines its definitions, everyone that wishes to participate will adhere to the Board's definitions.

Second, the National Skill Standards Board needs to make sure that what it promotes is representative of the entire world of work. The following statement in the background paper is a perfect example regarding this point.

> The need for broad clusters arises from the fact that industrial processes, occupations and job incumbents are changing so quickly that it is no longer economical to think of educating, training, and certifying to a single occupation, but rather to an occupational field or cluster.

When I read this statement I know the author has been listening to Marc Tucker and Anthony Carnevale and that's fine because they're excellent writers and make very compelling arguments for their points of view. However, if you read their work very closely the majority of their emphasis is on the high tech-internationally competitive-high performance manufacturing environment where down sizing, flattening of the organization, and team based problem solving are becoming the norm. In other sectors of the economy such as the service sector, the same computer and electronics driven technology is causing work to become more and more specialized rather than more and more generalized. A closing statement on the last page of the discussion paper reports Carnevale's (1992) contention that the current work force approximately matches the needs of its employers who in turn are reluctant to change from the old work structure to the new one. This is very true and must be considered in any plan for revision. However, one must take into consideration every point made by Carnevale in America and the New Economy since he strongly infers later in the book that other sectors of the economy, such as the service sector, may need to be addressed separately since they represent challenges that are different from manufacturing. The key point here is that if we're talking about manufacturing as our focus, let's say that. Let's don't over generalize when it doesn't apply.

There is no question that all workers need higher level academic and workplace skills, however, indepth analysis shows that the transportability and generalizability of these skills isn't as clear cut as some would lead us to believe it is. There is strong evidence to suggest that the basic skills, advanced academic skills and SCANS/Workplace Skills should be delivered as a base for all students whether they are college bound or work bound and then be further reinforced in the context of the occupation they are to be applied in. These type of skills should become the backbone for the certificate of initial mastery. This is the approach already being used by the state of Oregon who is in the process of implementing a CIM/CAM model.

Some points of concern as we look to develop new concepts of occupational skills clustering are as follows:

- The work force, particularly the potential work force in America, is much more heterogeneous in terms of race, creed, original nationality, family structure and social attitudes than many of the European and Asian countries that we tend to study or make comparisons. In this regard we need to be careful about trying to implement models that are national in scope when many of our states are larger and more diverse than the countries we are being compared to. For instance, if California and Texas were countries they would be fifth and seventh in Gross National Product when compared to all other countries. They also happen to be the largest and most diverse states when demographics and social problems are added to the equation. Consequently,

national policy makers must always be aware that the primary executors of policy in the United States are the state and local government units, not the federal agencies.

- Equal attention needs to be given to ALL SECTORS of business and industry particularly to the small business sector where most of the new jobs are being created. These sectors are not as inclined to invest as heavily in training. Large industries tend to want to employ persons who have the entry level skills in occupations for which they have the capability of providing the job specific training. Generalized Work Behaviors (GWB) and Workplace Literacy Skills (WLS) are important but without occupational skill training these individuals are only ready for the lower level skill jobs that require short term on-the-job training programs. The upper fifteen percent of our business and industries tend to train in-house by choice. We need to ask why are they getting all of the attention when the real need for publicly supported education and training is elsewhere in the economy.

- Management of big business and industry are good at talking about the importance of Generalized Work Behaviors (GWB), and Work Place Literacy (WPL) as long as they can hire the skilled people they need off the street or steal them from other companies. The minute they cannot hire the people they need with the skills they want, they scream for help. Twenty five years of experience in working with business/industry in the establishment of training programs for both small and large industries at the local, state and national levels, has led us to conclude that, in generalized discussion and from national platforms, representatives from large industries talk GWB and WPL, but when they sit down with vocational/technical educators and trainers, they talk about the development of skills in specific occupations or skills related to a specific process or a specific piece of equipment. They talk about <u>CUSTOMIZED TRAINING</u>.

- In some small industry units there are significant skill shortages. In most states the small machining operations are not looking for GWB and WPL. Instead, they want persons already trained to meet their serious skill shortages immediately. Of course, they want workers with GWB and WPL competencies, but they want them to have the basic educational skills before they enter training and to gain the work habits attitudes and basic industry knowledge while they are in training.

- No system of occupational/skills clusters can ignore industry employment trends or policies or the educational programs that prepare people for employment. There is little question that the number of low skilled production occupations and the number employed in them will continue to decline. There is little question that those occupations that the Board should address first should come from those industries and occupations with the largest numbers of skilled workers in the areas of greatest change due to technology.

DEFINING AN OCCUPATIONAL CLUSTER

The vocational-technical education community defines an occupational cluster as a group of occupations and/or job skills that can be grouped together based on their common characteristics such as functions, duties, tasks, and skills. Many people are professing that we can organize all occupations under about 16 - 20 clusters. Others argue that the number should be between 200 to 300 clusters. For those of us who have been around awhile, we know that the vocational and technical education community has been having this discussion for years. In fact, the U. S. Department of Education had the same discussion about twenty years ago when Dr. Sidney Marland's Career Education concept was in vogue. His office even conducted several research projects which resulted in the identificaiton of fourteen different occupational clusters. Today most state vocational agencies operate under eight broad clusters, as illustrated in Figure 1, page 9. These eight categories have their roots in federal reporting structures for programs operated. However, they do not assume that anyone is competent at the broad cluster level since it is viewed as a broad based introduction to the field. Competence is taught and/or certified by occupations or job titles.

Based on years of experience we recommend that the U.S. Department of Labor forget about trying to describe "clusters" in an "industry wide" context since industries just don't form ideal clusters as well as occupational groupings do. Looking "industry wide" also opens the door for duplication of effort across industry lines unless the system is very closely monitored. Duplication is already occurring within some of the National Skill Standards Projects as illustrated by the fact that no less than three of the projects are talking about doing something in industrial maintenance. There is also considerable potential for duplication in the electrical and electronics skills projects since there are three different projects in this field. For example, the American Electronics Foundation (AEA) Skills Standards Project just made a recent announcement that they plan to develop standards for administrative support personnel in their industry as one of three areas for further study. Not to pick on AEA, but administrative support personnel cut across every business and industry and should be viewed as an occupational cluster unto itself. If it's not, every major business and industry trade association will be trying to look at this occupational cluster. Furthermore, this is an area that V-TECS and MAVCC, as well as several of state vocational and technical agencies have already analyzed to the point that it could be easily assembled from existing resources in a very short period of time and then verified by using business and industry stakeholders. Experience has revealed that industry-wide clusters just don't sort out as easily and as defensible as do occupational clusters when assessment becomes the focal point. Admittedly, there are cases where groupings of occupations equal an industry when the term industry is more narrowly defined.

FIGURE 1
TYPICAL WAY OF ORGANIZING VOCATIONAL TECHNICAL EDUCATION IN MOST STATES AS SUMMARIZED BY THE AMERICAN VOCATIONAL ASSOCIATION IN A RECENT BROCHURE DESCRIBING THIS ENTERPRISE

Areas of Study

The hundreds of programs available to vo-tech students usually fall into these eight major areas of study:

- Health occupations, such as nursing, medical and dental assistants and radiologic technicians.
- Business education, including accounting, office occupations and business management programs.
- Trade and industrial education, which imparts occupational skills in a range of trades, including auto mechanics, construction, manufacturing, graphic arts and cosmetology.
- Agriculture, including horticulture, agricultural mechanics and agribusiness.
- Marketing education, including general merchandising and the marketing of apparel and accessories, real estate and financial, business and personal services.
- Technology education, including engineering, architecture, drafting, electronic communications, graphic arts, biotechnology, and transportation.
- Home economics, which encompasses consumer and homemaking education as well as occupational fields such as food services and professional child care.
- Technical education, which involves instruction at the postsecondary level in a variety of technical occupational fields, such as communications, engineering-related technologies and computer sciences.

Source: American Vocational Association "Vocational Technical Education Today" (Brochure). (1994) Alexandria, Virginia, Page 3.

Broad categories such as "Automotive Industry" or "Construction Industry" do not serve as good occupational skills clusters when worker certification is the goal. People are not employed into the automotive or automotive service industry. They are employed as automotive technicians, brakes specialists, auto body repairers, etc. A generalizable approach in the automotive industry as well as numerous other service clusters will not prepare people for employability. The depth of skill, knowledge, work habits and attitudes required in the sub-units of such classifications as automotive repair, auto body repair, medium/heavy truck repair, warrant identification as independent occupational/skills clusters since persons trained as automotive technician specialists are able to work for automotive service providers throughout the nation. Automotive technicians almost never cross over to become auto body repairmen, and seldom crossover to become medium or heavy truck technicians. The ever changing technology in each of these occupational/skills clusters warrants separate identification and certification. Parallel examples can be developed for numerous other technical service industry occupational clusters.

A redesigned occupational/skills cluster classification system, must make provisions within the occupational/skills cluster for the occupations that are represented in the major sub-divisions of the skilled occupation as defined by experts in the industry. As an example, the automotive repair occupation involves eight major sub-divisions, engine repair, automotive transmission, manual drive/train, suspension and steering, brakes, electrical system, heating and air-conditioning, and engine performance. Persons work as specialists in one or more of these specialized areas and have a high level of mobility based on their level of competence and the needs of the workplace. The same is true in construction, heating, air conditioning, refrigeration, etc.

Skilled occupations change as technology changes but occupational/skills clusters are more durable than many might consider them to be. There were carpenters fifty years ago and there will be carpenters ten year from now; however, they will perform their tasks with new materials and technologies which require different skills and knowledge. Persons presently working in these occupational/skills clusters will probably still be employed in the same occupational family but will be required to obtain upgrade training on an on-going basis in order to stay current. Contrary to popular belief, the tasks that these workers will perform over time will not change that much if they were properly identified and verified to start with. What will change are the materials and technology that drive the processes, not the tasks that are performed. Another interesting factor about new job formulation is that there are not very many brand new jobs or occupations that emerge that require totally brand new tasks. What generally happens is that already known skills from three to four existing technologies tend to merge. For example, Robotics represents the merger of electronics, pneumatics, mechanics and hydraulics tasks and skills.

Statistics related to persons employed in occupational/skills clusters are needed as a basis for determining which clusters should be addressed for evaluating training needs, in terms of growth and replacement. Such information cannot be determined from individual employers. Occupational families or clusters lend themselves much more readily to the gathering of labor market data which are critical to this effort. One of the major problems that local program deliveries have had for years is that the structures for collecting labor market data doesn't match the structure for organizing occupational clusters and delivering programs.

WHAT CLASSIFICATION SYSTEM BEST SERVES THE PURPOSE OF OCCUPATIONAL CLUSTERS

To address the questions of what occupational classification system best serves the clustering of occupational and skills, this author went back and reviewed each system identified in the background paper to get a better grasp since he did not use most of the systems on a daily basis. To facilitate the process of focusing on each system, a format was developed which provides an extract of the major codes and titles for each sub system. At least one breakout for each subdivision or tier was included to fully illustrate the various levels or tiers included. For each system the author has provided comments regarding how useful each system has been or could be in terms of accurately defining occupational skill clusters. An element by element, side-by-side review of the proposed Database of Occupational Titles has been presented in a two column format for ease of review and to insure a direct correlation for each point discussed.

To expedite this process, the Department of Labor and Department of Education should:

1. Convene a meeting of every agency that publishes an Educational, Industrial or Occupational Classification System for the purpose of arriving at one system that serves all purposes. It is very difficult for a person in the field to make sense out of these documents, especially, when it involves trying to crosswalk between and among them.

2. Broaden the search beyond those listed in the background paper. At a minimum, ED and DOL need to look at the Classification of Instructional Program (CIP) and the Vocational Preparation and Occupations (VPO) as well as those listed in the background paper.

3. Initiate a project to identify the best elements of each system beyond what is presented in these papers.

4. Use the outcomes as the organizational framework for specific occupational clusters in the new DOT structure.

If agreement cannot be reached across agencies to develop one classification system, DOL and ED should conduct a staff review and synthesis of these different systems and arrive at one that will support the work of the National Skill Standards Board as well as the development of the DOT and the collection of meaningful labor market information. As can be seen by reviewing the following pages, much can be learned in a very short period of time that can be very instructive to the process.

STANDARD INDUSTRIAL CLASSIFICATION (SIC)

Other than being used as a crosswalk for major industrial categories, the SIC is not of much value for structuring skill standards and occupational clusters since its major focus is on workplace establishments as contrasted to work being performed. A close look at some of the third tier occupational titles reveals that selected titles and ways of looking at business and industry are antiquated since they tend to reflect the Taylor model of industrial organization. Beyond its use as a crosswalk for broad based industrial/occupational tables, the SIC does illustrate the value of having at least three tiers for the array of titles by level. In many ways the SIC closely parallels the descriptors used for the first two levels of the Classification of Instruction structure which is detailed later in this paper. Table 1 represents the major divisions used in the SIC. Figure 2 illustrates how sub headers are listed under a typical two-digit category.

TABLE I
STANDARD INDUSTRIAL CLASSIFICATION (SIC) MAJOR DIVISIONS*

Division A	Agriculture, Forestry and Fishing
Division B	Mining
Division C	Construction
Division D	Manufacturing
Division E	Transportation, Communications, Electric, Gas, and Sanitary Services
Division F	Wholesale Trade
Division G	Retail Trade
Division H	Finance, Insurance and Real Estate
Division I	Services
Division J	Public Administration
Division K	Non classifiable Establishments

Source: National Occupational Information Coordinating Committee, Vocational Preparation and Occupations. Third Edition, Volume 1: Education and Occupational Code Crosswalk. Washington: The Committee, 1982, Pages I/4 - I/10.

FIGURE 2
TYPICAL SIC SUB-GROUPING FOR
DIVISION D: MANUFACTURING

36	ELECTRICAL AND ELECTRONIC MACHINERS, EQUIPMENT & SALES	
	361	Electric Transmission and Distribution Equipment
	362	Electrical Industrial Apparatus
	363	Household Appliances
	364	Electric Lighting and Wiring Equipment
	365	Radio and Television Receiving Equipment, Except Communication Types
	366	Communication Equipment
	367	Electronic Components and Accessories
	369	Miscellaneous Electrical Machinery, Equipment and Supplies

Source: National Occupational Information Coordinating Committee, Vocational Preparation and Occupations. Third Edition, Volume 1: Education and Occupational Code Crosswalk. Washington: The Committee, 1982, Page I/4.

OCCUPATIONAL EMPLOYMENT SURVEY (OES)

Of the classification systems listed in the background paper, the OES probably needs more work than any of the others since it lists occupational titles under broad generic titles. While it does use a three-tier structure, the CIP as well as other systems already offer better three tier structures; consequently, it is not recommended that the OES be reworked for the purposes outlined in this paper. However, if the focus is on worker roles, it could be useful since some of the titles do a good job of clustering like types of work from different industries together, i.e., molder, patternmakers, rollers and finishers, etc. Since it is basically a job title classification system, it might be useful in bringing the current DOT list down to a manageable number. Table 2 illustrates the major OES Groupings, while Figure 3 provides breakouts for a typical sub set.

TABLE 2
OCCUPATIONAL EMPLOYMENT SURVEY (OES) MAJOR GROUPING *

Major Code Number	Title
00000000	Total, All Occupations
10000000	Professional, Technical and Kindred Occupations
20000000	Managers and Officials
30000000	Sales Clerks
40000000	Other Clerical Workers
50000000	Crafts and Kindred Workers
60000000	Operatives
70000000	Service Workers
80000000	Laborers Except Farm
90000000	Farmers and Farm Workers

Source: National Occupational Information Coordinating Committee, Vocational Preparation and Occupations. Third Edition, Volume 1: Education and Occupational Code Crosswalk. (Washington: The Committee, 1982, Pages G/1 - G/28.

FIGURE 3

CONVERSION TABLE: OES SURVEY-BASED MATRIX OCCUPATIONAL CODES AND TITLES TO OES SURVEY OCCUPATIONAL CODES AND TITLES

MATRIX OCCUPATIONS		OES SURVEY OCCUPATIONS	
CODE	TITLE	CODE	TITLE
50060000	METAL WKG CRAFTS WKRS, EX		
50060200	BLACKSMITHS	55A20	BLACKSMITH
50060400	BOILERMAKERS	55A24	BOILERMAKER
50060600	HEAT TREATERS, ANNEALERS,	55J85	HEAT TREATER,ANNEALER
50060800	FORGE & HAMMER OPERATORS		
50060803	FORGING PRESS OPERATOR	55I94	FORGING PRESS OPERATOR
50060803	HAMMERSMITHS, OPEN DIE	55J70	HAMMERSMITH, OPEN DIE
50060804	HEADER OPERATORS	55J84	HEADER OPR
50061000	JOB & DIE SETTERS, METAL		
50061002	DIE SETTERS	55H69	DIE SETTER
50061003	MACHINE TOOL SETTERS, M	55L04	MA TOOL SETTER, METAL
50061005	SETTERS, MOLDING & CORE	55N94	SETTER MOLDING/COREMK
50061007	PUNCH PRESS SETTERS, ME	55R79	PUNCH-PRESS SETTERS, M
50061008	SHEAR &/OR SLITTER SET	55R81	SHEAR/SLITTER SETTER
50061009	SETTERS, PLASTIC MOLDING	55S28	SETTER, PLAST MOLD
50061200	MACHINING OCCUPATIONS		
50061202	LAYOUT MARKERS, METAL	55K61	LAY-OUT MARKER, METAL
50061206	MACHINISTS	55B84	MACHINIST
50061600	MILLWRIGHTS	55B95	MILLWRIGHT
50061800	MOLDERS, METAL		
50061801	METAL MOLD MAKERS	55L21	METAL MOLD MAKER
50061804	MOLDERS, BENCH &/OR FLO	55L57	MOLDER, MACHINE
50061805	MOLDERS, MACHINE(METAL)	55L62	MOLDER, PATTERN
5006180	MOLDERS, PATTERN	55P13	SHELL-MOLD-CORE MA O
50061808	SHELL MOLD/SH CORE MAC		
5006220	PATTERN & MODEL MAKERS		
50062202	PATTERNMAKERS, PLASTICS	55M06	PATTERNMAKER, PLASTIC
50062203	PATTERNMAKERS, METAL	55M09	PATTERNMAKER, METAL
50062204	PATTERNMAKERS, WOOD	55M10	PATTERNMAKER WOOD
50062206	PATTERNMAKERS, STONE	55M12	PATTERNMAKER, STONE CUT
50062209	MODEL &/OR MOLD MAKERS	55V10	MODEL AND/OR MOLD MK
50062400	ROLLERS & FINISHERS, METAL		
50062403	FORGING/STRAIGHTENING	55I95	FORGING/STRAIGHTENING
50062404	GUIDE SETTERS	55J68	GUIDE SETTER
50062407	MANIPULATORS, TABLE/BED	55R99	MANIPULATORS, TBL/BED OP
50062415	ROLLING MILL OPS/ATTEN	55N32	ROLLING-MILL OPR
		55V01	ROLLING MILL OP/ATTND
50062416	ROLLING MILL OPERATOR	55V02	ROLLING MILL OP HELP
50062600	SHEET METAL WORKERS	55C81	SHEET METAL WORKER
50063000	TOOLMAKERS & DIEMAKERS		
		55K21	INSTRUMENT MAKER
50063001	TOOL & DIE MAKERS	55D23	TOOL AND DIE MAKER
		55H66	DIE MAKER
50063003	DIE SINKERS	55H70	DIE SINKER

Source: National Occupational Information Coordinating Committee, Vocational Preparation and Occupations. Third Edition, Volume 1: Education and Occupational Code Crosswalk. Washington: The Committee, 1982, Page G/12.

STANDARD OCCUPATIONAL CLASSIFICATION (SOC) SYSTEM

Of the coding structures listed in the background paper, the SOC is probably the most useful system for creating occupational clusters. However it needs to be updated and many of its titles need to be merged to better serve this purpose. A close examination of the next page illustrates why this whole issue is so complex as well as why industry-wide clusters using broad generalizable skills won't work due to the vast number of job titles and settings where work is performed. Another document that will be described later already does this better. Table 3 shows the major categorical titles for the SOC while Figure 4 depicts its sub-categories. A simple thing like indenting would help better differentiate among the different levels.

TABLE 3
STANDARD OCCUPATIONAL CLASSIFICATION (SOC) SYSTEM *

Major Code Number	Major Categorical Titles
11, 12, 13, 14	Executive, Administrative and Managerial Occupations
16	Engineers, Surveyors and Architects
17-18	Natural Scientist and Mathematicians
19, 20, 21	Social Science, Social Workers, Religious Workers and Lawyers
22, 23, 24, 25	Teachers, Librarians, Counselors
26, 27, 28	Health Diagnostic and Treating Practitioners
29, 30	Registered Nurses, Pharmacists, Dietitians Therapists, and Physicians Assistant
31, 32, 33, 34	Writers, Artists, Entertainers, Athletics
36	Health Technologists and Technicians
37, 38, 39	Technologists and Technician Except Health, Engineering and Science
40, 41, 42, 43, 44	Marketing and Sales Occupations
45, 46, 47	Administrative Support Occupations, including Clerical
50, 51, 52	Service Occupations
55, 56, 57, 58	Agricultural Forestry and Fishing Occupations
60, 61	Mechanics and Repairers
63, 64, 65	Construction and Extractive Occupations
67, 68,69	Precision and Production Occupations
71, 73, 74, 75, 76, 77, 78	Production Worker Occupations
81, 82, 83	Transportation and Material Moving Occupations
85, 86, 87	Handlers Equipment Cleaners Helpers and Launders
91	Military Occupations
99	Miscellaneous Occupations

Source: National Occupational Information Coordinating Committee, Vocational Preparation and Occupations. Third Edition, Volume 1: Education and Occupational Code Crosswalk. Washington: The Committee, 1982, Pages E/1 - E/13.

FIGURE 4
TYPICAL LISTINGS WITHIN A SOC CATEGORY

Precision Production Occupations	
67	SUPERVISORS; PRECISION PRODUCTION OCCUPATIONS
68	PRECISION PRODUCTION OCCUPATIONS
681-2	PRECISION METAL WORKERS
6811	Tool and Die Makers
6812	Precision Assemblers (Metal)
6813	Machinists
6814	Boilermakers
6816	Precision Grinders, Filers, and Tool Sharpeners
6817	Patternmakers and Model Makers (Metal)
6821	Lay-out Workers
6822	Precision Hand Molders and Shapers (Jewelers)
6823	Engravers
6824	Sheet Metal Workers
6829	Miscellaneous Precision Metal Workers
683	PRECISION WOODWORKERS
6831	Patternmakers and Model Makers, Wood
6832	Cabinet Makers and Bench Carpenters
6835	Furniture Finishers
6839	Miscellaneous Precision Woodworkers
684	PRECISION PRINTING OCCUPATIONS
6841	Precision Typesetters
6842	Precision Lithographers and Photoengraver
6844	Bookbinders
6849	Miscellaneous Precision Printing Occupations
685	PRECISION TEXTILE, APPAREL AND FURNISHINGS WORKERS
6852	Tailors and Dressmakers, Hand
6853	Upholsterers
6854	Shoemakers and Leather Workers Repairers
6855	Precision Laundering, Cleaning, and Dyeing Occupations
6856	Apparel and Fabric Patternmakers
6859	Miscellaneous Precision Apparel and Fabric Workers
686	PRECISION WORKERS; ASSORTED MATERIALS
6861	Precision Hand Molder sand Shapers (Except Jewelers)
6862	Precision Patternmakers, Lay-out Workers and Cutters
6863	Detail Design Painters and Decorators
6864	Optical Goods Workers
6865	Dental Laboratory Technicians
6866	Gem and Diamond Working Occupations
6867	Precision Electrical and Electronic Equipment Assemblers
6868	Photographic Process Workers
6869	Miscellaneous Precision Workers, Not Elsewhere Classified
687	PRECISION FOOD PRODUCTION OCCUPATIONS
6871	Butchers and Meat Cutters
6872	Bakers
6873	Matchmakers (Candymakers, Cheesemakers, Etc.)
6879	Miscellaneous Precision Food Workers
688	PRECISION INSPECTORS, TESTERS, AND RELATED WORKERS
6881	Precision Inspectors, Testers, and Graders
6882	Precision Adjusters and Calibrators

Source: National Occupational Information Coordinating Committee, Vocational Preparation and Occupations. Third Edition, Volume 1: Education and Occupational Code Crosswalk. Washington: The Committee, 1982, Pages E/9 - E/10.

CLASSIFICATIONS OF INSTRUCTIONAL PROGRAMS (CIP)

One of the best classification documents for creating meaningful occupational clusters is not even an occupational classification system. It is the Classifications of Instruction Programs, developed by the National Center for Education Statistics, U. S. Department of Education. At first glance the typical reader would not agree with this contention; however, when the program titles that are normally accessed through the traditional higher education degree route are stripped away, what is left is a set of titles and codes that given a few word changes could rapidly become a structure for defining clusters using broad based occupational groupings. Those familiar with how better vocational technical education programs are operated know that these programs are organized around clusters not specific job titles as is often characterized by the field's detractors. By looking at Figure 5, one can readily see how clusters can be easily formed at the four and/or six digit level. If you count the four digit codes for technical programs in the current CIP manual, you arrive at 70 occupational clusters. If the six digit titles are used, the total number falls between 150-160.

The reason the CIP is so useful is that Dr. Robert Morgan and his fellow developers at NCES came to the task with very strong occupational training backgrounds. They also knew how important it was to make the codes and titles as occupationally descriptive as possible. They developed the CIP model after studying and borrowing from each of the existing structures listed in the background paper. Another plus for the CIP is that it is the most current of the documents reviewed, consequently, it comes the closest to reflecting today's world of work and it can be easily modified as work changes.

If the 1990 CIP Codes and Titles and the Fourth Edition DOT Codes and Titles are crosswalked, there is a surprisingly close fit between the two, especially when compared to the relationship between '84 CIP and the Third Edition DOT. This has come about because the 1990 CIP contains rewritten occupational program descriptions that read more like occupational cluster titles while the simultaneous process of eliminating approximately 18,000 job titles from the DOT has resulted in the remaining 12,000 titles being broader descriptions resulting in a closer fit between the two structures when DOT job titles are crosswalked to the CIP program titles. Another major advantage of the CIP is that it already has much of the educational degree/certificate equivalency information built in; consequently, a matrix could be easily created showing the traditional education and training requirements for all occupations from top management down through occupational titles that represent the basic threshold skills needed to enter any field at any point. The CIP is a very easy document to interpret since its six-digit, three-level structure creates a hierarchy in terms of broad to more specific titles. If further definition is needed, two digits could be added to the present six-digit structure to create an eight-digit structure which could include even more specific occupational or job titles represented within a cluster. Please refer to Table 4, Figure 5, and Figure 6 for specific details regarding the major codes and titles for CIPs, typical sub-titles, and sample definitions for related titles. Appendix A shows how V-TECS has used the CIP to organize its existing titles so that it can begin to develop broader based clusters as it updates its existing materials.

TABLE 4
UNITED STATES DEPARTMENT OF EDUCATION
1990 CLASSIFICATION OF INSTRUCTIONAL PROGRAM CODES AND TITLES

Codes and Titles for All Program Groups		Codes and Titles Which Cover the Majority of the Occupational Program or Clusters that Would Likely Occur in a Skill Standards Environment	
01	Agricultural Business and Production	01	Agricultural Business and Production
02	Agricultural Science	02	Agricultural Science
03	Conservation and Renewable Natural Resources	03	Renewable and Natural Resources
04	Architectural and Related Programs		
05	Area Ethnic and Cultural Studies		
08	Marketing Operations/Marketing Distribution	08	Marketing and Distribution Occupations
09	Communications		
10	Communications Technologies	10	Communication Technology Occupations
11	Computer and Information Sciences	11	Computer and Information Sciences Occupations
12	Personal and Miscellaneous Services	12	Personal and Miscellaneous Occupations
13	Education		
14	Engineering		
15	Engineering - Related Technologies	15	Engineering and Engineering Related Technology
16	Foreign Languages and Literature		
19	Home Economics (*** Degree or Non-paid)		
20	Vocational Home Economics/Consumer and Homemaking Programs	20	Vocational Home Economics and Consumer Occupations
21	Technology Education/Industrial Arts	21	Technology Education
22	Law and Legal Services		
23	English and Literature/Letters		
24	Liberal Arts and Sciences, General Studies and Humanities		
25	Library Science		
26	Biological Science/Life Science		
27	Mathematics		
28	Reserve Officers Training Corps		
29	Military Technologies	29	Military Technology Occupations
30	Multi-Interdisciplinary Studies		
31	Parks Recreations Leisure and Fitness Studies	31	Parks, Recreations, Leisure & Fitness Occupations
32	Personal Improvement and Leisure Program/Basic Skills		
33	Citizenship Activities		
34	Health Related Knowledge and Skills		
35	Interpersonal and Social Skills		
36	Leisure and Recreational Activities		
37	Personal Awareness and Self-Improvement		
38	Philosophy and Religion		
39	Theological Studies and Religious Vocation		
40	Physical Sciences		
41	Science Technology	41	Science Technology Occupations
42	Psychology		
43	Protective Services	43	Protective and Legal Service Occupations
44	Public Administration and Science		
45	Social Science and History		
46	Construction Trades	46	Construction Trades
47	Mechanics and Repairs	47	Mechanics and Repairs
48	Precision Production Trades	48	Precision and Production Occupation
49	Transportation and Material Movers	49	Transportation and Material Movers
50	Visual and Performing Arts	50	Applied Art and Design Occupations
51	Health Professions and Related Services	51	Health Related Occupations
52	Business and Management and Administrative Services	52	Business Management and Admn Service Occupations
53	High School/Secondary Diploma Certificates		

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 1 - 48

FIGURE 5
TYPICAL SUB LISTINGS FROM THE CLASSIFICATION OF INSTRUCTIONAL PROGRAMS (CIP) *

15. ENGINEERING-RELATED TECHNOLOGIES

15.01 Architectural Engineering Technology

15.0101 Architectural Engineering Technology/Technician

15.02 Civil Engineering/Civil Technology

15.0201 Civil Engineering/Civil Technology/Technician

15.03 Electrical and Electronic Engineering-Related Technology

15.0301 Computer Engineering Technology/Technician
15.0303 Electrical, Electronic and communications Engineering Technology/Technician
15.0304 Laser and Optical Technology/Technician
15.0399 Electrical and Electronic Engineering-Related Technologies/Technicians, Other

15.04 Electromechanical Instrumentation and Maintenance Technology

15.0401 Biomedical Engineering-Related Technology/Technician
15.0402 Computer Maintenance Technology/Technician
15.0403 Electromechanical Technology/Technician
15.0404 Instrumentation Technology/Technician
15.0405 Robotics Technology/Technician
15.0499 Electromechanical Instrumentation and Maintenance Technologies/Technicians, Other

15.05 Environment Control Technologies

15.0501 Heating, Air Conditioning and Refrigeration Technology/Technician
15.0503 Energy Management and Systems Technology/Technician
15.0505 Solar Technology/Technician
15.0506 Water Quality and Wastewater Treatment Technology/Technician
15.0507 Environmental and Pollution Control Technology/Technician
15.0599 Environmental Control Technologies/Technicians, Other

15.06 Industrial Production Technologies

15.0603 Industrial/Manufacturing Technology/Technician
15.0607 Plastics Technology/Technician
15.0611 Metallurgical Technology/Technician
15.0699 Industrial Production Technologies/Technicians, Other

15.07 Quality Control and Safety Technologies

15.0701 Occupational Safety and Health Technology/Technician
15.0702 Quality Control Technology/Technician
15.0799 Quality Control and Safety Technologies/Technicians, Others

. . . . . (More listed, but not used)

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 15-16.

TABLE 5
TYPICAL SUB LISTING FROM THE CLASSIFICATION OF INSTRUCTIONAL PROGRAMS (CIP) *

47. MECHANICS AND REPAIRERS

47.06 Vehicle and Mobile Equipment Mechanics and Repairers

47.0603 Auto/Automotive Body Repairer
47.0604 Auto/Automotive Mechanic/Technician
47.0605 Diesel Engine Mechanic and Repairer
47.0606 Small Engine Mechanic and Repairer
47.0607 Aircraft Mechanic/Technician/Airframe
47.0608 Aircraft Mechanic/Technician, Powerplant
47.0609 Aviation Systems and Avionics Maintenance Technologies/Technician
47.0610 Bicycle Mechanic and REPAIRER
47.0611 Motorcycle Mechanic and REPAIRER
47.0699 Vehicle and Mobile Equipment Mechanics and Repairers, Other

48. PRECISION PRODUCTION TRADES

48.01 Drafting

48.0101 Drafting, General
48.0102 Architectural Drafting
48.0103 Civil/Structural Drafting
48.0104 Electrical/Electronics Drafting
48.0105 Mechanical Drafting
48.0199 Drafting, Other

48.02 Graphic and Printing Equipment Operators

48.0201 Graphic and Printing Equipment Operator, General
48.0205 Mechanical Typesetter and Composer
48.0206 Lithographer and Platemaker
48.0208 Printing Press Operator
48.0211 Computer Typography and Composition Equipment Operator
48.0212 Desktop Publishing Equipment Operator
48.0299 Graphic and Printing Equipment Operators, Other

48.05 Precision Metal Workers

48.0501 Machinist/Machine Technologies
48.0503 Machine Shop Assistant
48.0506 Sheet Metal Worker
48.0507 Tool and Die Maker/Technologies
48.0508 Welder/Welding Technologies
48.0599 Precision Metal Workers, Other

49. TRANSPORTATION AND MATERIALS MOVING WORKERS

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 15-16.

TABLE 6
TYPICAL DESCRIPTORS FOR EACH CODE AND TITLE FROM THE CLASSIFICATION OF INSTRUCTIONAL PROGRAMS

15.06		Industrial Production Technologies. A group of instructional program that prepare individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and using industrial processes.
		. . . . .
*	15.0603	Industrial/Manufacturing Technology/Technician. An instructional program that prepares individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and using industrial manufacturing system and processes. Includes instruction in design and prototype testing, instrument calibration, operational and maintenance procedures, operational diagnosis and repair, applications to specific system and products, and report preparation.
*	15.0607	Plastics Technology/Technician. An instructional program that prepares individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and using industrial polymers. Includes instruction in the principles of macromolecular chemistry, polymerization and plastic manufacturing processes and equipment, design, and operational testing procedures, equipment maintenance and repair procedures, safety procedures, applications to specific products, and report preparation.
*	15.0611	Metallurgical Technology/Technician. An instructional program that prepares individuals to apply basic engineering principles and technical skills in support of engineers and metallurgists engaged in developing and using industrial metals and manufacturing processes. Includes instruction in principles of metallurgy, related manufacturing systems, laboratory techniques, testing and inspection procedures, instrument calibration, system and equipment maintenance and repair, applications to specific processes, and report preparation.
*	15.0699	Industrial Production Technologies/Technicians, Other. Any instructional program in industrial production and technologies not described above.

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 96-97.

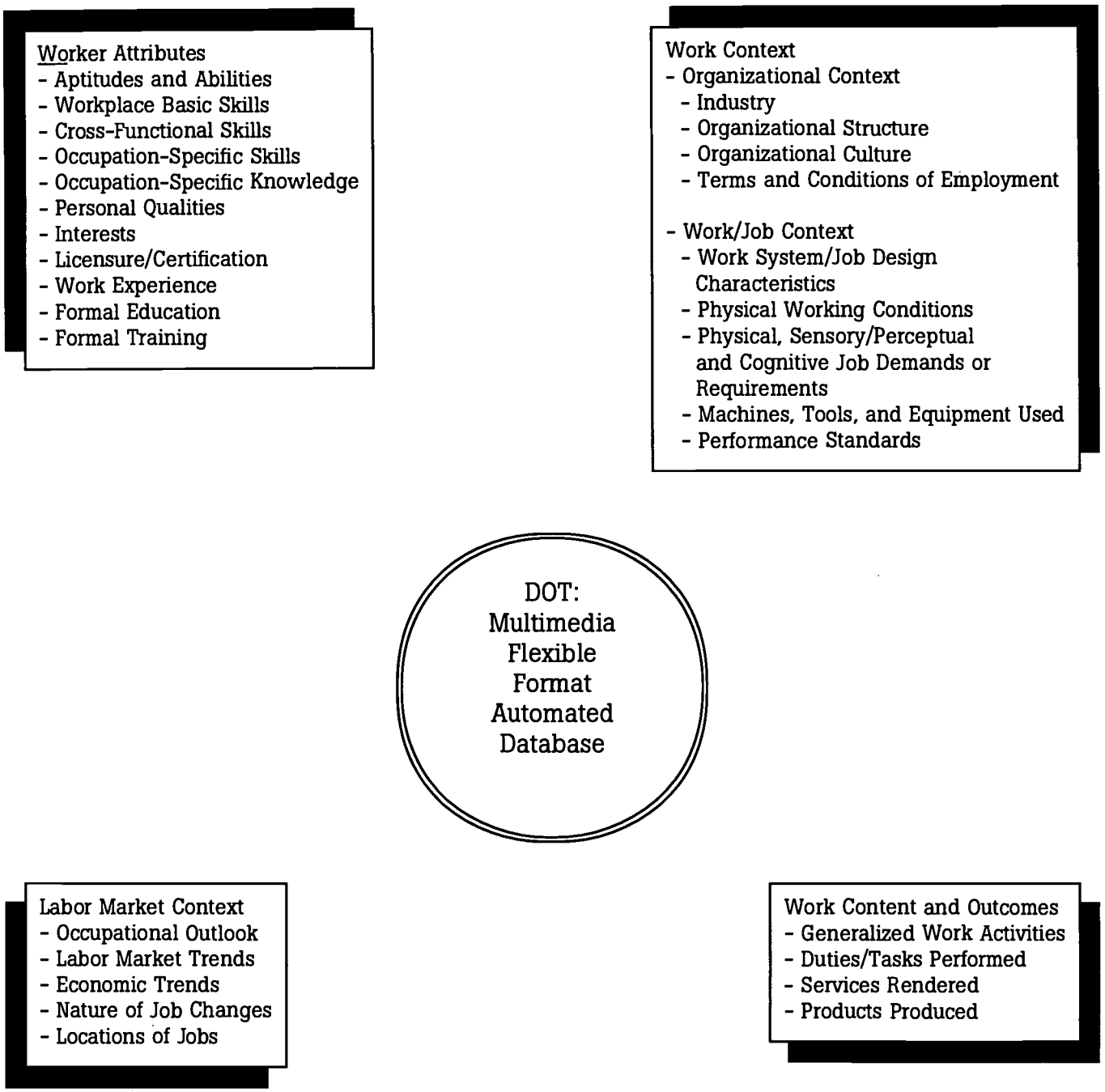
DICTIONARY/DATABASE OF OCCUPATIONAL TITLES

Given that the decision has been made to design a Database of Occupational Titles (Figure 6 and Table 7) instead of revising the Dictionary of Occupational Titles, this author has chosen to endorse the concept and simply comment on the importance of each element of the proposed data base rather than critique an extinct document. At V-TECS the DOT is used to assign codes to occupational analysis outcomes where applicable and meaningful. Since V-TECS has historically conducted occupational analysis around what it calls occupational domains or clusters, which are simply groupings of occupational job titles that are similar enough to serve as a solid and reliable research base. The DOT is used to indicate that a given domain relates to certain DOT's; not as a concrete title to develop around. Since 1983 V-TECS has used the Vocational Preparation and Occupations (VPO), the National Occupational Information Coordinating Committee (NOICC) as its primary source document for crosswalking the Classification of Instructional Programs (CIP) Codes and Titles and the Dictionary of Occupational Titles because it is already formatted to provide a direct crosswalk between these two code structures as well as across other coding structures such as SOC, OES, etc.

This author totally supports moving the DOT information to a database environment. The APDOT has done an outstanding job of thinking through the various elements and descriptors that should be included in the database; however, when each sub-descriptor is studied carefully, there appears to be some potential for overlap. Consequently, further consolidation should be seriously considered given the potential magnitude of this database.

Another thing very critical to the marketing and usability of this database is that it should be developed around a software shell that treats each category or set of descriptors as independent element so that each user can input as little or as much information into their DOT system as they need depending on how they intend to use the information. This is how we developed the V-TECS DIRECT Software System. For instance, while we believe labor market information is very important, we don't use it on a daily basis to the degree we would worker attitudes, work content, or outcome information. The worst thing you can do to a database of this size is to try to satisfy everyone's needs to the degree you overload its capabilities to the point that no one can use it. When you do so, you wind up satisfying no one because every element added means more disk space occupied with a direct slowdown in access time.

FIGURE 6
THE NEW DOT CONTENT MODEL



Source: United States Department of Labor, Employment and Training Administrative Advisory Panel on the Dictionary of Occupational Titles. The New Dot: A Database of Occupational Titles for the Twenty First Century. (Final Report) 1993, Washington, DC. Page 32.

TABLE 7

DOT CONTENT MODEL	
I. Worker Attributes This section includes a series of descriptor categories related to the characteristics or qualifications that a worker brings to a job. The first five descriptors listed represent an approximate hierarchy or continuum of skills-related information (moving from general to increasingly specific levels of description and analysis) that is expected to provide a wide range of application options for users requiring skills information of different types and at different levels of specificity. It is expected that appropriate verification, elaboration and specification of these descriptor categories and their specific component elements will require further research.	
DESCRIPTOR	CRITICALITY
Aptitudes and Abilities. The capacity to perform particular classes or categories of mental and physical functions; examples include: cognitive abilities (examples include: verbal, quantitative, abstract reasoning), spatial/perceptual abilities (examples include: spatial orientation and visualization, perceptual speed, flexibility and speed of closure), psychomotor abilities (examples include: arm, manual, and finger dexterity, eye-hand coordination), sensory abilities (examples include: vision, hearing, color discrimination) and physical abilities (examples include: static strength, dynamic strength, stamina, extent flexibility).	VERY IMPORTANT and should definitely be a part of the DOT. Selected data elements need to be more clearly defined. If things such as reasoning can't be better quantified than in the current DOT, just leave it out.
Workplace Basic Skills: Fundamental developed abilities that are required to at least some degree in virtually all jobs. Examples include: reading, writing and arithmetic or computational abilities. (These are included as a separate descriptor category because, although related to aptitudes and abilities, they include significant knowledge and learning components.)	VERY IMPORTANT. Things like reading, writing, arithmetic, need to be defined or quantified and made as contextual as possible. For example, write sentences is not near as descriptive as write sentences using technical terms.
Cross-Functional Skills. The various types of developed generic skills that are related to the performance of broad categories of work activity that tend to occur across relatively wide ranges of jobs. Examples include: information gathering, oral communication, problem analysis, negotiating, organizing and planning, coordinating with others and coaching or mentoring.	VERY IMPORTANT. Same comment as above. Descriptors need to be tied to functions. Problem analysis in one occupation is quite different than it is in another. In air conditioning, one person usually analyzes a failed component following a diagnostic process while in manufacturing problems may be solved by a team using a pre-determined problem solving process.

Occupation-Specific Knowledge. Understanding or awareness of, or familiarity with, the facts, principles, processes, methods, or techniques related to a particular subject area, discipline, trade, science, or art. Includes knowledge of foreign languages, computer programming languages and specific compute software packages or applications. Examples include: financial planning and analysis, fire protection systems, computer graphics, data communication networks, patent law, Spanish, COBOL, and spreadsheet software.	VERY IMPORTANT. Could be combined with or included in work content.
Personal Qualities. An individual's characteristic, habitual, or typical manner of thinking, feeling, behaving, or responding with respect to oneself, others, situations, or events. Examples include: self-esteem, sociability, responsibility and integrity/honesty.	MODERATELY IMPORTANT. This category could be included in workplace skills by using a set of slightly different descriptors.
Interests. Expressed affinity for performing particular types or categories or work tasks or activities, or applying particular types of skills. Examples include: realistic, investigative, artistic, social, enterprising and conventional.	MODERATELY IMPORTANT. Could be left out or incorporated into other descriptors that specify types of work. This is generally assumed to be part of analyzing one's background and should not necessarily be in this database since it is somewhat duplicated in other sections.
Licensure/Certification. The type of name of particular state licenses or professional or technical certification programs required for given jobs or possessed by an individual. Examples include: Board of Certified Safety Professionals (BCSP) certification; Certified Public Accountant (CPA); Registered Nurse licensure; American Production and Inventory Control Society (APICS) certification; and Academy of Certified Social Workers (ACSW) certification.	IMPORTANT now. Will become even more important as time goes on as more and more systems are in place to certify workers.
Work Experience. The type and amount of either paid job experience (acquired in regular full- or part-time employment, military jobs, paid apprenticeship, internship, or trainee positions) or unpaid job experience (acquired in volunteer or civic activities or in student work-study programs) required or characteristic of workers in a given job or possessed by an individual.	IMPORTANT but should be kept very brief and concise. Could be combined with licensure/certification information since these tend to require work experience as a part of the qualification criteria.
Formal Education. The type and amount of secondary school, vocational-technical school, college, or university education required or characteristic of workers in a given job or possessed by an individual.	IMPORTANT. Often closely related to licensure/certification and work experience.

Formal Training. The type and amount of learning or instruction, acquired through such means as apprenticeships, certification programs, military training programs, practicums and organization- or association-sponsored training programs (but outside of formal academic or educational settings) required or characteristic of workers in a given job or possessed by an individual.	Should have one category for formal education and training. As we move toward a skills environment, the distinction between degrees and certificates will tend to merge.
II. Work Context This section includes descriptors for Organizational Context and Work/Job Context. Organizational context includes descriptors related primarily to the broader organizational system within which work is carried out. Work/Job Context includes descriptors related to the more immediate job context. It should be noted that some of the descriptor categories and component elements listed in this section (more so than in other sections) are prone to vary as a function of the specific setting, location or type of organization in which a job is performed, and hence may not represent generalizable characteristics of a job or its context. APDOT's view is that this determination should be based on empirical job analysis. Such data can then be used to determine the most appropriate manner of treating such characteristics in a DOT occupational description.	
ORGANIZATIONAL CONTEXT	
Industry. The major or defining activity or purpose of the establishments in which a given job is performed, such as defined in the Standard Industrial Classification (SIC) system. Examples from the current SIC include: Retail Trade, Finance, Insurance, Real Estate, and Health Services.	Use a crosswalk concept similar to that of the VPO.
Organizational Structure. Includes such elements as: • size of organization (examples include: number of employees, divisions, work units) • type of organization (examples include: non-profit, conglomerate, multinational) • degree of product or service diversity or specialization • mode of organizational structure and production control (examples include: hierarchial versus flat, centralized versus decentralized) • Reward structure (examples include: bases for wage and salary treatment, bases for performance and promotion evaluation)	VERY IMPORTANT. In some ways this category indirectly infers those things that tell people whether their interest match the place of employment.

Organizational Culture. Includes such elements as: • operating values/style (examples include: institutional fairness, employee involvement, open communication, customer focus, continuous learning environment, entrepreneurial, diversity, social responsibility) • strategic emphases (examples include: quality, speed of production, innovation, low cost, automation/technology infusion)	SAME COMMENT AS ABOVE. This again tells me whether I would be interested in an occupation based on my interest.
Terms and Conditions of Employment. Includes such elements as: • work schedule (examples include: hourly, shift work, daily) • type of compensation (examples include: salary, wages, fee-for-service, incentive or commission) • amount of compensation (examples include: ranges) • travel or relocation requirements • degree to which work is unionized • special clothing or uniform requirements	VERY IMPORTANT. However, the wages category will require a significant amount of upkeep.

WORK/JOB CONTENT	
Work System/Job Design Characteristics. The characteristic manner in which a given job is designed and work is organized, especially in relationship to other aspects of the organizational system of which the job is a part. (Note: The combination of many of these elements may be used to define what has come to be called a "high performance" workplace or organization, and hence may help to determine the degree to which it is appropriate to characterize a given organization or work setting in this manner.) Examples of such elements include: • degree of shared or interdependent task or job responsibility (examples include: team vs. individual organization of work) • degree and nature of interactions with technology • decision making and/or dollar accountability (examples include: degree of empowerment, autonomy or latitude for judgment) • degree to which job entails performance of a variety of tasks or use of a variety of skills • degree of task or job identify • skill or knowledge acquisition or maintenance demands (examples include: degree to which frequent or continuous learning is required) • nature of job impact (examples include: remote, indirect, contributory, shared, direct) • degree of job impact (examples include: sphere of influence, number of people affected) • degree of structure (examples include: presence of formal guidelines, policies or standard procedures) • pace or intensity of work • degree and duration of contact with others • scope and nature of communications or interactions with others • degree of stability or dynamism in work schedules, methods and procedures or job duties and responsibilities • degree and type of performance feedback available	VERY IMPORTANT. But tends to replicate some of the sub-descriptors shown under the other major descriptors in this category.

Physical Working Conditions. The nature of the immediate physical environment in which a job is performed. Includes such elements as: • the nature or type of work setting (examples include: indoor/outdoor) • type of work location (examples include: factory, office) • physical hazards present (examples include: chemicals, radiation, combustibles, etc.) • physical discomforts present (examples include: noise, vibration, odors, dust, fumes, etc.)	SAME COMMENT AS ABOVE.
Physical, Sensory/Perceptual and Cognitive Job Demands or Requirements. An occupation's characteristic type and degree of physical (examples include: standing, carrying, lifting, climbing, stooping), sensory/perceptual (examples include: color or auditory discrimination, depth perception) and cognitive (examples include: vigilance or information encoding, processing and retrieval) job demands.	VERY IMPORTANT to guidance counselors since you can't legally tell a disabled person they can't do a certain task or job but you can advise them that if they go into a given occupation they will have to lift objects weighing 150 lbs, or climb a ladder, which leaves the decision regarding degree of disability to the individual based on how they perceive themselves.
Machines, Tools and Equipment Used. Physical instruments or devices used to carry out or facilitate the completion of particular jobs, work activities or tasks. Examples include: printing press, electric hoist, bulldozer, milling machine, pneumatic hammer, tape measure, camera, photocopying machine, facsimile machine, laptop computer, radio transmitter and vide recorder.	VERY IMPORTANT.
Performance Standards. The nature of the production or quality criteria by which the work performed in a given job is typically judges or evaluated. Examples include: amount produced, quantity sold, error or defect rates and timeliness of production or service.	VERY IMPORTANT but is already reflected in other sections. Could also be tied to Products Produced by Adding to What Standard.
III. Work Content and Outcomes This section includes a series of descriptor categories related to the content of the work actually carried out by an individual and the outcomes resulting from this work.	
Generalized Work Activities. Aggregations of related duties or tasks into somewhat more general activity statements that do not include highly job-specific content. Examples include: writing technical reports, reading blueprints, preparing budgets and repairing electrical appliance.	IMPORTANT. Somewhat duplicative of what we define as cross-functional skills. Some of these can also be duties or task performed, given the context of discussion.

Duties/Tasks Performed. The specific work steps, elements, or activities performed in order to achieve a given work objective. Examples include: locate and repair leaks in pressurized cable, prepare written replies to customer inquiries or complaints and type and proofread statistical reports.	VERY IMPORTANT. If this section is developed properly, it will reveal a lot about basic skills, workplace skills, etc.
Services Rendered. The services provided by an individual or organization based on the work that individuals or work teams perform. Examples include: guidance and counseling, cleaning, teaching and medical testing.	REDUNDANT
Products Produced. The products designed, developed, made, or manufactured by an individual or organization based on the work that individuals or work teams complete. Examples include: automobile parts, compact discs and food products.	REDUNDANT. Section III Work Content and Outcomes could be combined with Section I and eliminate a lot of redundancy.
IV. Labor Market Context This section includes a series of descriptor categories related to the boarder economic and labor market setting in which jobs are performed, as well as information regarding how these factors affect given jobs. It is expected that the information comprising this category will not be obtained from the job analysis process used to gather data on individual jobs, but rather from linkages with other databases and information sources such as those developed by the U.S. Office of Personnel Management (OPM), Bureau of Labor Statistics (BLS), and the U.S. Department of Education.	
Occupational Outlook. Information related to the future of the occupation, describing potential educational and occupational requirements and employment prospects. Examples include: BLS information on occupational outlook and OPM projections for future employment.	IMPORTANT
Labor Market Trends. Information related to current and future employment in specific occupations. Examples include: total employment for specific occupations.	IMPORTANT
Economic Trends. INFORMATION related to economic patterns that have implications for employment. Examples include: growth patterns by industry and/or occupation.	IMPORTANT
Nature of Job Changes. Information related to changes in occupations. Examples include: changes in employment, occupational requirements and industry.	Couldn't this be a part of the occupational outlook?

Locations of Jobs. Information related to location of occupations geographically or within the organization. Examples include: total employment of specific occupations by geographic area, organizational unit where occupation may be located such as printing department, audio visual department.	Could be covered in Section II under industry, or organizational structures.

OTHER POSSIBLE SYSTEMS

TABLE 8
CARNEVALE'S THIRTEEN SIGNIFICANT INDUSTRIES OF THE FUTURE ECONOMY *

1.	The Automotive Industry
2.	The Food Industry
3.	The Chemical and Pharmaceutical Industry
4.	The Commercial Aircraft Industry
5.	The Consumer Electronics Industry
6.	The Chip Industry
7.	The Computer Industry
8.	The Machine Tool Industry
9.	The Wholesale and Retail Industry
10.	The Health Care Industry
11.	The Housing Industry
12.	The Apparel Industry
13.	The Financial Services Industry

Carnevale also acknowledges the critical role of the National Resources Construction, Manufacturing and Service Industry in the future economy.

Source: Carnevale, A.P. America and the New Economy. 1992, Washington, DC: U. S. Department of Labor and American Society of Training and Development, 1992.

TABLE 9
CAREERS FOR THE 90s

THE OPPORTUNITIES WITHIN VOCATIONAL-TECHNICAL EDUCATION ARE BROAD AND DIVERSE. THE FOLLOWING ARE AN EXAMPLE OF CAREERS AND PROGRAMS AVAILABLE:

	No. of Workers in 1986	Growth to 1995 (%)	Current Ave. Salary (approx)
AGRICULTURE			
Farm managers	154,000	31%	$18,000-45,000
Agriculture machinery service technical	18,00	4-10%	$15,000
Paravets	3,440	NA	$18,000-45,000
BUSINESS			
Paralegals	54,000	97.5%	$20,000-25,000
Insurance underwriters	78,000	22%	$22,000
MARKETING			
Wholesale & Retail Buyers	192,000	9%	$19,000-28,000
Marketing, Advertising & Public Relations Manager	323,000	32%	Varies: $25,000-80,000
HEALTH			
Dental hygienists	76,000	29%	$18,000
Medical records technicians	33,000	31%	$17,000
Emergency medical	47,000	7%	$16,000-20,000
Radiologic technicians & technologists	115,000	23%	$25,000
HOME ECONOMICS			
Food service/lodging service	657,000	14%	$27,000
Childcare workers	572,000	4-10%	$12,000-16,000
TECHNICAL			
Aviation maintenance	107,000	20%	$15,000-60,000
Engineering technicians	730,000	40%	$20,000-25,000
Electrical & Electronics technicians	313,000	46%	$22,000-30,000
CAD/CAM drafting technicians	345,000	11-16%	$21,000
Computer operators	263,000	47%	$16,000-24,000
Computer service technicians	55,000	56%	$22,350
Computer systems analyst	331,000	76%	$22,000-35,000
TRADE & INDUSTRIAL			
Bricklayer & Stonemasons	161,000	16%	$400-600/week
Carpenters	944,000	11%	$12-16/hour
Automotive Technicians	922,000	20%	$10-13.50/hour
Electricians	545,000	16%	$13-15.50/hour
Chemistry-based technicians	81,000	NA	$24,388-60,000

Source: U.S. Department of Labor, Bureau of Labor Statistics as published by the National Council on Vocational Education, Time for Action: Washington, 1991.

VOCATIONAL PREPARATIONS AND OCCUPATIONS (VPO)

Another very useful document not mentioned in the background paper is the Vocational Preparations and Occupations (VPO) which was developed by the National Occupational Information Coordinating Committee (NOICC) to serve as a crosswalk between program titles and occupational titles. Its two original data bases were the 1984 Classification of Instructional Programs Codes and Titles and the Third Edition of The Dictionary of Occupational Titles. It is strongly recommend that once the new DOT Content Concept is put in place that the VPO be updated to reflect this new system. It is an excellent document and has been invaluable to V-TECS and the various states in expediting the process of crosswalking occupations within our information systems and occupational training materials without having to consult five or six different references. Figure 7 shows how it is put together.

When we first started using it, its major weakness was that the Third Edition of the DOT was based on far too many job titles which made clustering very difficult. Today NOICC has moved most of its crosswalks to a software environment which is much better. The National Crosswalk Service Center (NCSC) is a technical resource center of the National Occupational Information Coordinating Committee (NOICC) and State Occupational Information Coordinating Committees (SOICs). NCSC maintains the NOICC Master Crosswalk and provides a range of products and services based on the Crosswalk and other Federal occupational and labor market information resources. NCSC is operated by the Iowa SOICC under a grant from NOICC.

The NOICC Master Crosswalk is a computerized database that shows relationships among the five major occupational and educational classification systems used by the Federal government. The Crosswalk begins with the Dictionary of Occupational Titles (DOT), which is the common denominator used to link all Federal classification systems. Through the Master Crosswalk, data classified according to each of the Federal classification systems can be related to data classified according to one or all of the other systems. In cooperation with NOICC and other Federal agencies, the National Crosswalk Service Center manages and updates the Master Crosswalk; provides technical assistance in its use; and answers requests for data and information. NCSC also services as a depository of computerized occupational and educational information resources, including:

- NOICC Master Crosswalks
- Bureau of Labor Statistics (BLS) Crosswalks
- BLS National Industry/Occupation Projections Matrix
- Dictionary of Occupational Titles (DOT) Manual
- Standard Occupational Classification (SOC) Manual
- Classification of Instructional Programs (CIP) Manual
- Standard Industrial Classification (SIC)
- Occupational Employment Statistics (OES) Survey Dictionaries
- Standard Occupational Classification (SOC) Career Profiles
- Occupational Outlook Handbook
- Military Occupational and Training Data
- States depend very heavily on NOICC's and SOICC's; consequently, they need to be directly involved in this effort

FIGURE 7
SAMPLE FROM VOCATIONAL PREPARATION AND OCCUPATIONS

PROGRAM: 47.0302 HEAVY EQUIPMENT MAINTENANCE AND REPAIR.

AN INSTRUCTIONAL PROGRAM THAT PREPARES INDIVIDUALS IN THE FIELD MAINTENANCE OF HEAVY EQUIPMENT, AND IN GENERAL MAINTENANCE AND OVERHAUL OF SUCH EQUIPMENT. INCLUDES INSTRUCTION IN INSPECTION, MAINTENANCE, AND REPAIR OF TRACKS, WHEELS, BRAKES, OPERATING CONTROLS, PNEUMATIC AND HYDRAULIC SYSTEMS, ELECTRICAL CIRCUITRY, ENGINES, AND IN TECHNIQUES OF WELDING AND BRAZING.

DICTIONARY OF OCCUPATIONAL TITLES		GED			S V P	PHYSICAL	WORKING	OTHER CIP	1980 SOC	OES SURVEY	MATRIX	1980 CENSUS
CODE	FOURTH EDITION TITLE	R	M	L		DEMANDS	CONDITIONS	PROGRAM	CODE	CODE	CODE	CODE
184.167-170	SUPERINTENDENT, MAINTENANCE	4	4	3	7	556	I		1342	19000	20061699	019
221.367-030	LOCOMOTIVE LUBRICATING-SYSTEMS CLERK	3	2	3	5	S45	I		4752	62003	40062400	363
620.261-022	CONSTRUCTION-EQUIPMENT MECHANIC	3	3	3	7	M346	B57		6117	51034	50081803	516
620.281-042	LOGGING-EQUIPMENT MECHANIC	4	3	3	7	V23456	B56		6117	51034	50081803	516
620.281-046	MAINTENANCE MECHANIC	4	3	3	7	M34	I56	47.0604	6111	51008	50081001	505
620.281-058	TRACTOR MECHANIC	4	3	3	7	M346	I4	01.0204	6112	51034	50081803	507
620.381-018	MECHANICAL-UNIT REPAIRER	4	3	3	7	M456	B		6117	51008	50081001	516
620.381-022	REPAIRER, HEAVY	3	2	3	6	H46	I5		6111	51008	50081001	505
620.664-010	CONSTRUCTION-EQUIPMENT-MECHANIC HELPER	2	1	2	3	M346	B56		8632	56900	80002823	864
622.381-014	CAR REPAIRER	4	3	3	7	H23456	B56		617	51066	50082803	516
622.381-018	CAR REPAIRER, PULLMAN	4	3	3	7	M2346	B		6117	51066	50082803	516
622.381-022	CAR-REPAIRER APPRENTICE	4	3	3	7	H23456	B56		6117	51006	50082803	516
622.684-010	AIR-COMPRESSOR MECHANIC	3	3	3	6	L46	I	47.0401	6117	51066	50082803	516
910.367-010	BRAKE COUPLER, ROAD FREIGHT	3	2	3	4	M2346	B6		8233	55A29	62001600	825
910.384-010	TANK-CAR INSPECTOR	3	2	3	4	M2346	06		8280	51066	50082803	689
910.387-014	RAILROAD-CAR INSPECTOR	3	2	3	5	L346	0		8280	55B58	50142202	689
915.687-018	LUBRICATION SERVICER	2	1	1	4	M34	I		8730	55D67	61082605	825

CONCLUSIONS REGARDING CLASSIFICATION SYSTEMS

Based on everything that was reviewed and summarized herein, it is recommended that a three or four tier classification system be developed for both the DOT and the occupational cluster classification system. A set of titles for each occupational family is shown below. They have been derived by broadening the context of the Occupational Titles shown on the right side of TABLE 4, Classification of Instructional Programs. With a few word changes in the base list plus the addition of such terms as arts, finance, education and training, we can develop a schema that can also include management and higher level clusters. Once these modified titles were derived, they were matched against the other systems under review to insure inclusiveness. It's interesting how closely this list parallels the prototype system being developed for DOL using the Canadian model as a base.

The Occupational Family Titles that emerge are:

CIP Codes	MODIFIED CIP TITLES
01, 02, 03	AGRICULTURAL, FORESTRY, NATURAL RESOURCE OCCUPATIONS
08	MARKETING AND DISTRIBUTIVE OCCUPATIONS
	PERSONAL SERVICE AND MISCELLANEOUS OCCUPATIONS
09, 10	ARTS AND COMMUNICATION OCCUPATIONS
14, 14, 15, 41	ENGINEERING AND SCIENCE RELATED OCCUPATIONS
08, 20, 31	HOSPITALITY AND TOURISM OCCUPATIONS
22, 43	PROTECTIVE AND LEGAL SERVICES OCCUPATIONS
46	CONSTRUCTION TRADES OCCUPATIONS
47	MECHANICS/TECHNICIANS, INSTALLERS, REPAIRER SERVICE OCCUPATIONS
48	PRECISION AND PRODUCTION OCCUPATIONS
49	TRANSPORTATION AND MATERIAL MOVING OCCUPATIONS
51	HEALTH OCCUPATIONS
44, 52	BUSINESS, FINANCE MANAGEMENT AND ADMINISTRATION
13	EDUCATION AND TRAINING OCCUPATIONS

To take this concept one step further, the following four-, six-, or eight-digit system could emerge whereby clusters could be developed at at least two levels. The CIP would be invaluable in setting up this concept.

00.	Occupational Family/Industry
00.00	Occupational Cluster/Programs
00.0000	Occupational Specialties/Clusters/Skills
00.000000	Occupational Job Titles

This model covers every option and allows for clusters to emerge at two ore more levels which is extremely important since level of specificity tends to vary based on the industry or occupation being reviewed.

Level 5	CEO, Management Administration - Advanced Degree
Level 4	Supervisor - Basic Degree or Advanced Certificate
Level 3	Master Technician/Journeyman Level - Postsecondary Degree or Certificate
Level 2	Specialist Level - Postsecondary Certificate; Secondary Certificate; On-the-Job Training
Level 1	Trainee Exit Level/Position Entry Level - Secondary Diploma or Certificate of Mastery

Once the clusters have been identified, a matrix could be developed by crosswalking each cluster to the specific levels and types of education and certification needed. A good model to look at is the one currently being developed by the DOL Metalworking Skills Standards Project.

LESSONS FROM THE ASE/NATEF MODEL

Contrary to popular belief, the idea of national skill standards is not a new one, not even in this country. The U.S. Military has been certifying competnece against skill standards for years. The automotive, printing, and construction industries, as well as the unions are experts in this area. Probably the most widely recognized public sector effort that can be used as an on-going model is that of the National Institute for Automotive Service Excellence and the National Automotive Technician Education Foundation (ASE/NATEF).

Classification of work in America needs to consider how people are trained and how they are employed. Any new classification system must consider the educational and skill levels required of an occupation which clearly define the core skills that constitute entry level training. The automotive service industry is one of the industries that received one of the Department of Education Grants for development of national industry based skill standards for its training programs. The National Institute for Automotive Service Excellence (ASE) which represents an already successful model is a broad consortium of thirty-five representatives from all facets of the automotive industry. It was initiated by the industry in 1972 to improve the quality of automotive service throughout the nation. To satisfy its industry, ASE established a program of certifying technicians as competent at a specific level rather than at a broad based entry level. Any person, regardless of how they gained their skills can take one or more of eight tests and become certified in the areas passed. If the person passes all eight specialty classification tests, they are then identified as a master technician. They must recertify every five (5) years, since technology in the automotive industry changes significantly during this period of time. What most people don't realize is that it takes years of training and experience to become a master technician. Very few training programs are capable of turning out master technicians in any field at the initial exit points of their programs. In addition, most upgrade training in this field is provided by industry based schools that tend to be manufacture specific, as new models are released or updated systems are introduced.

While the automotive service industry might not be considered an occupational/skills cluster, given some of the consolidation concepts presented in the discussion paper, the industry cannot employ people using an industry wide concept. Its context or cluster is automotive service and repair with certificaiton based on the identification and validation of competencies in a specialty area of the occupation or at a master technician's level given all specialty areas. The pattern of testing used in this field permits a person to progress from a specialist to a master technician when they are competent in some 560 tasks that have been identified and validated by other master technicians nationwide; consequently, an ASE certified person in any of the areas listed above is employable nation-wide and is not tied to any one employer, automotive brand name or region of the country. Any occupational classification system that ignores training patterns and standards established by an industry will lead to utter confusion in that industry.

The point of this discussion is that we are rapidly buying into a philosophy or concept that is based almost totally on what is occurring in the manufacturing sector of the economy

when manufacturing constitutes less than 25% of the workforce and is still dropping. While the manufacturing sector is moving to a more generalizable context, other sectors of the economy are not. We need to realize that we are not dealing with a one size fits all world of work.

Since the ASE/NATEF standards for automotive training have been in operation for a period of twenty years, the new funds from the Department of Education funds are being used to update the standards for automotive technicians, auto body technicians, and medium/heavy truck technicians. In addition, a major part of the project is aimed at identifying the principles of language arts, science, and math related to the tasks in these areas in order to clearly identify the basic skills in the 3Rs and science essential for entry into training for these three areas. This could essentially become the Certification of Initial Mastery for this field that is called for at age 16 in several of the European countries.

The development of industry standards for the three occupational areas identified above would have been a rather useless effort without a procedure for encouraging automotive programs to also adopt the standards. To this end, this industry has invested about $175,000.00 annually to provide support for a program that gives ASE certification to those programs that meet industry standards. The cost to local programs undergoing certification is approximately $500.00 per school. Without industry support, the cost would be $2,500.00 to $3,000.00. Consequently, ASE/NATEF addresses the quality of individual technicians as well as the quality of individual programs. Other skill standards projects should also adopt this concept. The air conditioning and refrigeration industry has already made this change in its plan of operation.

It should be noted that policies and standards for program certification encourages broad based training for entry level technicians. For example, there are eight sub areas of training in entry level automotive technician training, five in auto body repair and nine in medium/heavy truck. No automotive technician program can be certified unless it meets ASE standards in at least four of the areas and three of the four areas, dealing with the most technical of the eight areas, are specified. As of February 1, 1994, 777 automotive training programs had been certified throughout the nation with all fifty states accepting the ASE/NATEF standards as a goal for their programs. Industry standards, based upon skilled or technical occupations, that encourage a broad based training can significantly improve the quality of entry level training in both public and private institutions.

The automobile service industry promotes training program certification at all levels of education, secondary, post-secondary adult technical institutes, community college, college, university and private schools. However, there is one standard for all programs, since occupational entry level is occupational entry level. In too many states the opportunity for adequate preparation for employment at the high school exit level is being destroyed and dropout rates are on the increase due to the increased graduation requirements which have had the effect of adding one extra credit of language arts, math, science and keyboarding to each graduate's plate without changing the way it is delivered. Broad based occupational/skill clusters, not related to employment patterns facing high school graduates,

has encouraged the academicians to delete preparation for work at the high school level which is resulting in an even greater dropout problem than we had before.

It should be understood that social considerations and economic necessities have a significant impact upon the point of entry of youth into the work force. For most young people, high school is the last chance they have for full-time education and training. To assume that the majority of youth will pursue post-secondary training for employment is to ignore the demographics regarding school dropout trends and population mixes.

The "A Nation at Risk" report has caused people to focus too much attention on the improvement of the quality of academic education at the expense of education for work which has become a two edge sword. While it is true that workers need more and better academic and workbased skills, most states have addressed this issue by trying to teach more of the same in the same old way. The key to real change is in how things are taught. After ten years of floundering around, this message is finally being recognized since people are now realizing that the major problem in education is centered around how people are taught as contrasted to what they are taught. Problem solving and teamwork are learned by solving problems and by working in teams, not by being told about problem solving or teamwork in a lecture format.

THE VOCATIONAL TECHNICAL EDUCATION ENVIRONMENT AND ITS PERCEPTIONS REGARDING OCCUPATIONAL/SKILLS CLUSTERS

As we move ahead in our school to work transition efforts, we need to maximize on the excellent capacity we already have rather than trying to totally reinvent the wheel. This country has over 20,000 public vocational and technical institutions and some fifty state agencies that are already providing leadership in most of the new initiatives such as Tech Prep, School to Work transition, and integration of academic and occupational skills. These 20,000 institutions break down as follows:

- More than 11,000 general or comprehensive high schools, where programs are offered in as many as six or more different vocational subjects; however, the majority of these students do not concentrate in vocational education in these schools.

- Several hundred vocational high schools, which offer full-time programs of study in both academic and vocational subjects where most of the students are enrolled in vocational-technical education programs.

- Almost 1,400 secondary area vo-tech centers. These are shared-time facilities that provide only vocational-technical education. Students receive the academic portion of their education at regular high schools or other institutions in the region or school system served by the vo-tech center.

- At the postsecondary level nearly 9,400 postsecondary institutions offer vocational programs. These include area vocational schools, technical institutes, skill centers and other specialized schools as well as community colleges and public and private two- and four-year colleges, which offer general academic programs as well.

Source: American Vocational Association, "Vocational Education Today" Brochure. Arlington, VA. 1994. Page 3.

A number of public vocational/technical centers are already initiating youth apprenticeship programs. One such center in Southern Ohio operates a consortium of a number of vocational planning districts that encompass virtually all of southwestern Ohio, except Cincinnati. The Plan calls for 3,500 hours of work based and school based training, starting with the summer between the 10th and 11th grades and continuing full-time until the completion of the 12th grade. The program will provide 2,200 hours of paid work based experience, and 1,300 hours non-paid school based education. There are minimum requirements for acceptance into the program that would approximate the European concept of initial mastery of the basics, that are identified for youth at the age of sixteen before they enter into occupational or professional training in the last two years of high school. Examples

of industries to be involved in this consortium effort include construction trades, banking, electrical, manufacturing and metal working, restaurant management, and food preparation.

Students enrolling in the program, however, will be entered into apprenticeable occupations, such as carpentry in the construction trades which involves a broad base of technical knowledge and skill along with the GWB and WPL. The wave of the future in job preparation outside of manufacturing will not be in broad clusters, but in skilled occupations such as residential or commercial construction as contrasted to narrow single jobs such as roofer or drywaller.

Impact on the Career Development Process

Any revision of the classifications of the occupational skills clusters should consider the potential impact on career development and guidance programs. While attitudes toward work and occupations are affected by many factors, including the home, family and peers, a career development program leading to occupational choice, preparation and employment require efforts within the school program and throughout life. Such a program should include:

K-6 Career Motivation - At this child development level individual occupations should not be the focus. Rather the focus should be upon the fact that people work to provide them with housing, food, transportation, health and protection. The focus is upon the importance of work in relation to things that directly affect them and their goal is to motivate them to respect all work and to want to participate in this wonderful world of work.

Grades 7-8. At this child development level, the focus should be upon the 15-17 major families of occupations in order to broaden their vision of what is possible beyond their meager observations and experiences. Again, at this level the focus should be upon expanding their vision not selecting a career.

Grades 9-10. This is an age of exploration and youth at this level can not be expected to relate to thousands of job classifications but initially to major occupations within the 15-17 orientation families and then to the opportunities for training and employment in such occupations. The occupations explored within the major clusters should be the type which offer opportunities for skilled, technical or professional employment. Such occupations normally require preparation in both knowledge and skill that makes them employable beyond one industry or business. It must be recognized that limitations of ability or motivation may limit a students employability to only a part of a highly skilled occupation, such as a muffler or brake repairmen versus a trained automotive technical. It is probable that any occupational classification system must reach to this operator level. It is at this point that this author would support a general job skills assessment vehicle that measured basic skill, academic skills and work place readiness skill such as SCANS. This is a logical exit point for the certification of initial mastery. Beyond this point people should start down a career track and work toward a certificate of achievement mastery..

Grades 11-12. In-depth preparation for work or preparation for technical or professional education beyond high school. Research in guidance indicates choice becomes reasonable at about age 16. It is recognized that choices must be allowed to change, but no choice, without preparation for a technological world that has little need for a size 3 hat and a size 1 shirt, is the worst possible choice. There is ample evidence that programs that are based on high standards and that provide adequate time on task in the last two years of high school can be very effective in preparing youth for entry level employment and for further training through apprenticeship, tech prep, or some other form of post-high education. Some would suggest that the present high school college preparatory program does nothing more than measure the academic intelligence of the students and needs to be redesigned in keeping with research on learning and curriculum design. The young person that graduates with GWB and WPL but no occupational training, is handicapped in obtaining employment except in the very low-skill, low-wage occupations. This is, in effect, what the so-called general diploma has been doing. Very few people who talk about how far the U.S. schools are behind Germany and Japan want to talk about the two real differences, length of time on task -- 180 6-hour days versus 220 8-hour days and that our schools attempt to treat all students equally.

Grades 13-16. Two year technical institutes and community colleges provide occupational training at the vocational, technical and college transfer levels. The availability of this instruction, however, requires the economic ability and social and personal motivations that makes this a selective level of education. Occupational/skill cluster classification are needed that identify technical level occupations that prepare students to work at functions assisting professional persons. Secondary and postsecondary training are going to have to continue to work more closely with industry since more and more of the training is going to have to occur on-site or in-plant due to equipment costs and copied technological changes.

This educational range also includes preparation for employment in the professions through our colleges and universities. A report from the Board of Regents in one state, however indicates that upon graduation only 25% of the graduates obtained jobs in the area for which they prepared. The occupational classifications identifying the professions and the limitation of opportunities in such professions are important to the long term skill needs of industry and business. Many college dropouts and disappointed college graduates would have made outstanding skilled workers but seldom enter such employment. Several postsecondary leaders (grades 13-14) tell us that 30% of their enrollment is made up of recent liberal arts graduates who can't find work and return to their institutions to learn a marketable skill.

Life Long Learning - vocational and technical education centers as well as other training normally accept a responsibly for retraining workers and providing update training for employed workers. A quality occupational skills cluster classification system must be able to gather data that will guide both workers and educational institutions to train in occupations in which there is a good chance of employment. Postsecondary institutions are playing a major role in providing updated and customized training to business and industry.

WHAT PROCESSES SHOULD BE USED

There is no one analysis process that will fit every occupational classification in every business or industry because of the way each business and/or industry is structured. First, it must be recognized that there are occupations which are structured in very linear patterns where one skill builds on another in an almost vertical or hierarchal pattern. Occupations such as the specialty areas in heating, air conditioning and refrigeration ten dto fit this mold. These workers tend to diagnose system and address failures. They tend to install, maintain, repair, and operate highly technical systems. On the other hand, a person who specializes in electronics has skills that are supportive to many occupational clusters such as HVAC, automotive, computer repair, etc.

Certain people want to write off many of the occupational and task analysis processes that have been used very successfully in the past. In their mind they try to draw a parallel between these approaches and Taylorism. They think that since task analysis results in very detailed information about task performance on a task by task basis, that each person will only perform one or two tasks in meaningless, low-paying jobs, such as those previously performed by many workers on an assembly line, or that they will pump gas instead of diagnosing the electrical or fuel system of an automobile. Nothing could be further from the truth. What occupational and task analysis provides is a total description of all aspects of an occupation. It provides the basics upon which the academic skills such as language arts, math, science, can be derived. V-TECS has even used a modified version of its occupational and task analysis process to identify and validate the list of Workplace Skills shown in Table 16 by using business and industry in seventeen states to verify these skills. Currently, performance based activities and assessment tools are being developed for each workplace skill and element. A list will be tied to every occupational cluster we analyze in the future. Occupational and task analysis does the best job of providing the documentation between training and work that is needed to develop reliable criterion referenced and performance based assessment vehicles.

As far as this writer is concerned, the jury is still out on the value of the work being done by ACT under the direction of Dr. Robert Korte. In reading the documentation describing this work, there is little doubt that the processes being used are sound and will stand the test of good research and assessment techniques. However, even if the study proves what it has set out to achieve, which is very possible, the use of generalizable skill statements don't mean much unless they are written in the context of their actual application. V-TECS has learned this lesson through its experience with the Snyder Taxonomy of Essential Skills which is used as a tool to identify academic skills for each occupational area. On the one hand, the Taxonomy is a tremendous tool since it can be used as a crosswalk across occupations and as a vehicle for making judgements about what language, math and science skills are embedded in each occupation so that we can determine what the core skills are in an occupational cluster; however, the skill itself is not mastered until it is practiced in context. Saying someone needs to be able to read or signal an equipment operation doesn't have much meaning until we add, what is being signaled and how it is being signaled. Signaling for a taxi is significantly different than signaling a jet on the deck of an aircraft carrier.

WHO SHOULD BE INVOLVED IN THE PROCESS OF SETTING AND USING SKILL STANDARDS

Most of the emphasis thus far has been placed on the involvement of business and industry trade associations as the prime leaders in the development of skill standards. Both Requests for Proposals for the National Skills Standards Projects stress that the stakeholders should be business, industry, labor and to a lesser degree educators and/or trainers. To date, one of the most impressive aspects of the National Skill Standards Projects has been the degree to which each project has been able to bring about the involvement of appropriate stakeholders. However, it is also evident that those projects that have also involved vocational-technical educators along with business and industry stakeholders have done a better job of developing standards in a language that both the workplace and the school house can understand and use. There is no question that what is taught in an occupational education and training program must come from the closest source to where work is performed which is at the incumbent worker or their supervisor level. In the event incumbents are not available, engineering specifications, plans and technical documents can serve as excellent sources of information. If future trends are needed they should be derived from management or CEO types.

Once we know what goes on in the workplace someone has to translate the information into curriculum and assessment tools that insure effective training and certification of skills. Vocational-technical education state leaders, JTPA providers, local instructors, labor and industry trainers are the ones who have to do this. Our feeling is that when this type of information gets too general it magnifies the problems of delivering meaningful instruction and training, especially, when developing assessment and certification tools which will stand the legal test are included. That is why so many people buy into the competency or performance based instruction concept since it focuses on using criterion referenced assessment tools that are based on actual workbase activities and standards of performance. Our plea is to involve educators as much as possible and recognize the work that has already been done in this arena by organizations such as V-TECS, Mid-America Vocational Curriculum Consortium (MAVCC), National Occupational Competency Testing Institute (NOCTI), and the competency based instruction and assessment systems in the states of Oklahoma, Arkansas, Ohio, Kentucky, North Carolina, as well as several others. They have already crossed many of these bridges and much can be learned from their experiences; just ask ASE, EIF and NACFAM how valuable their input has been. The V-TECS organization is described as an example in this paper but there are several others just as important. These organizations know who the real experts are in the conduct of this type of work since these people have spent their time doing it rather than philosophizing about it.

WHAT IS THE VOCATIONAL-TECHNICAL EDUCATION CONSORTIUM OF STATES? WHAT DOES IT DO?

The Vocational-Technical Education Consortium of States is a non profit organization made up of twenty-three state departments of vocational and/or technical education and six federal agencies that have agreed to work together to insure that what is taught in the classroom and/or the training environment is directly related to what goes on in the workplace. The consortium has been in operation since August, 1973, and has held steadfastly to the original purpose for which it was established which is as follows.

> The purpose of V-TECS is to promote the systematic development and implementation of the concept of competency-based vocational-technical education by securing the active participation of state agencies and other appropriate organizations who agree to concentrate on the following:
>
> - the analysis of occupations and the organization of job related information using representatives from business and industry as the primary source of the occupational content, standards and processes for doing the work.
>
> - the development of vehicles for assessing and certifying student competency attainment and gains against occupational performance standards in various occupational areas.
>
> - the design, development and/or acquisition of instructional and training materials as well as assessment vehicles which provide the VALIDATED LINK BETWEEN EDUCATION AND EMPLOYMENT.
>
> An underlying premise of V-TECS is that of insuring the easy transportation of HIGH QUALITY competency-based vocational-technical education materials across institutional and state lines for use as a base upon which HIGH QUALITY programs and assessment systems are developed and operated while conserving fiscal and human resources through the shared development and dissemination of information in both paper and software formats.

The current membership of V-TECS includes the states of Alabama, Arkansas, Arizona, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, and Virginia. Other states having held membership in V-TECS and having made contributions to its vast inventory of skill based materials are Delaware, Louisiana, Kansas, Missouri, New York, North Carolina, Texas, Utah, Washington, West Virginia and Wisconsin.

Associate members of V-TECS include the technical training commands of the U.S. Air Force, U.S. Army, U.S. Marine Corps and the U.S. Navy, the U.S. Bureau of Prisons and

the Bureau of International Labor Affairs of the U.S. Department of Labor. It should be noted that in 1973 the U.S. Air Force hosted the first two organizational meetings of V-TECS as well as the initial inservice on the U.S. Air Forces' Instructional Systems Design Model which V-TECS adapted and still uses in a modified form as its basic developmental process. The military is still very active in V-TECS since all four military training commands continue to use parallel processes for the development of their training and assessment materials. The V--TECS materials are shared with the military and V-TECS has immediate access to all military training materials that are not classified. In fact, V-TECS is working with the staff of the U.S. Army Training and Doctrine Command to adapt current Army training materials that are applicable to the civilian sector with little modification. It is baffling to us as to why the U.S. Department of Education and the U.S. Department of Labor doesn't include the technical training commands of the Army, Navy, Air Force, and Marine Corps in the national skill standards effort and for representation on the National Skill Standards Board.. They are the best in the world in occupational analysis, instructional design, criterion referenced assessment, and delivery of instruction. We need to spend some of our money studying what they do and how they do it instead of what's going on in Europe and Japan. The U.S. Bureau of Prisons uses V-TECS materials in the prison's school system while the Department of Labor uses V-TECS concepts and materials in its work with developing countries as a part of its economic development model. As a result of the DOL and World Bank relationships, V-TECS has hosted briefings and extended study tours for forty-one groups from thirty different countries. V-TECS has also conducted on-site training in competency based instruction and assessment in Chili, Mexico, and Uruguay.

What Does V-tecs Have to Address the National Skill Standards Efforts, School to Work Transition Initiatives, and the Perkins Act?

In its twenty year history, V-TECS has produced over 200 **Catalogs of Performance Objectives and Performance Guides** which provide detailed job descriptions for specific or related occupational clusters. Catalogs identify what workers do, how they do it, what they do it with and the all important level of expected performance (standard) for each task as validated by workers. V-TECS catalogs currently address over 700 of the occupational titles listed in the U.S. Department of Labor's Dictionary of Occupational Titles (DOT). Each catalog contains the **duties or functions** associated with an occupation, the specific **tasks** for each duty, a list of **performance steps** describing how each task is ordinarily performed by workers on the job, a performance objective which details the **standard** for acceptable performance in the work place, and a list of **conditions** (tools, equipment, environmental and safety considerations) for performing each task. **These elements are the primary resources for establishing the industry standards as applicable in the classroom or work place and for the measurement of student competency attainment and learning gains as well as for developing portable skill certification vehicles at the state and national level. When you have these elements you can write standards for task grouping, skill grouping, duties/function and occupations if you have them in interactive databases.**

The **V-TECS Curriculum Guide** is an extension of the catalog in that each task is analyzed by a team of instructors and workers to determine the knowledge, skills, and work

related behavior or attitudes required for the mastery of each task. **Based on this information, suggested instructional resources, activities, and worksheets are provided for use in the design and delivery of the actual training within the local program or industrial training environment as defined in the assessment and evaluation criteria contained in Perkins II.**

Using the task analysis information, V-TECS identifies **Enabling Competencies and Related Academic Skills** and codes them to the Snyder Basic/Essential Skills Taxonomy, to provide V-TECS users with a common language for identifying the academic skills embedded in all V-TECS occupational titles.

Perkins II calls for the determination of student competency attainment, student learning and competency gains in both academic and occupational skills, and skills certification using standards verified by business and industry. School to work calls for national or state standards and portable credentials certifying competence. Consequently, there is no better way to measure attainment than to have an evaluation tool tied directly to the task or duty level to be mastered by each student or trainee in a given occupational cluster. **The V-TECS Criterion-Referenced Test Item Banks** meet this specification since each test item is coded to a task. V-TECS item banks are stored on diskettes in ASCII format making them accessible on any MS-DOS computer system.

Another V-TECS resource is the **Automated Cross-Referencing Occupational System (ACROS)** developed by the State of Michigan as a resource for curriculum development; however, experience has shown this system to be a much more comprehensive tool since it is useful in working with business and industry to create specialized training programs, and in helping displaced workers find new occupations that make use of their current skills. ACROS is a computer-based system that combines elements from these three databases:

- 2,000 duty statements and over 30,000 task statements taken from 180 V-TECS task lists and tools and equipment lists and 45 Michigan task lists.

- The Vocational Preparation and Occupations Handbook which crosswalks the U.S. Department of Education's Classification of Instructional Programs and the Dictionary of Occupational Codes and Titles.

- 1,850 keywords from The Handbook of Occupational Keywords provide the link for searching across the entire task list data base for related duties and tasks. This means that where task lists do not already exist, searches can be made across all task lists to find duties and tasks which relate to specified concepts. The identified tasks then can be edited for use as a starting point for dialogue with industry in a number of areas.

Recently, V-TECS completed the development of a second piece of software that is proving to be invaluable in the conduct of this type of work and greatly enhances our ability

to keep the information current for many years to come. **This software, called V-TECS DIRECT, allows every element presently contained in each V-TECS product to be computerized and manipulated in an interactive database.** It is a software package designed for storing and retrieving V-TECS material as well as any other competency based data related to occupational and programmatic content.

V-TECS DIRECT provides each user the capability of reviewing and/or selecting specific elements of interest in a variety of ways: customizing the existing material to meet their requirements and entering their own material into the system. This concept provides maximum flexibility in merging task or competency lists for the development of cluster programs, as well as for the provision of task statements and performance objectives for determining performance standards and measures for vocational and applied technology programs at the local, state and national levels. V-TECS DIRECT can be used in a technical committee meeting to immediately enter, add or delete information from the duty/task list, and tools list or with subject matter experts to review and update any of the instructional or assessment elements contained in the system. A new feature allows the user to put task or skills together from every task list in the data base.

V-TECS DIRECT is **the** tool that we intend to use to help us keep up with the changes brought about by technology! We feel that having instructional and assessment information in a data base is the key to being current in the future.

The Future

In the future, it is assumed that the majority of all V-TECS products will be developed by the V-TECS central office by contracting with experts to do the work based on a set of priorities that are approved by the Board on an annual basis. This system will produce outcomes designed to help states and local agencies do a better job of meeting the intent of the standards and measures provisions of Perkins II, the JTPA, and School to Work opportunities, since each product will be reviewed using a set of rigid high-quality standards before being released to the field. In time this approach could also prove to be the best alternative for setting national standards for credentialing students and trainees since it has the advantages of (a) being in place, (b) having an established and respected process for accomplishing the work, (c) an existing base of operation for the long term dissemination of the outcomes, and (d) maximizing on what already exists rather than reinventing the wheel under another banner. In V-TECS alone, the following decisions have been made to address the following. This is the model we are using for the Heating, Air Conditioning and Refrigeration Skill Standards Project. With a broadening of context, this could become a framework for the development of national skill standards and training and assessment tools.

OUTCOME I: Implementing a System for the National Validation of Tasks and Performance Outcomes Involving the Appropriate Stakeholders --

V-TECS will identify and validate task lists and occupational competency standards on a national basis using a cross section of business, industry and labor and the military. Board and committee representatives from participating states will be directly involved in determining which priorities are addressed and how the system is designed and operated. The following items constitute major components of the system:

- The top occupational areas will be identified and prioritized on an annual basis for development and/or updating.

- Searches will be made of NNCCVTE, ACROS, V-TECS DIRECT in collaboration with other sources such as ACT, the Department of Defense (DOD) Associate Members and NOCTI to identify existing task lists and related resources that support the occupational titles being addressed.

- Preliminary duty and task lists will be formulated and validated using representatives from business and industry as well as the DOD Associate Members on a national basis.

- Standards will be formulated and verified by representatives from business, industry and the four DOD associate members.

- Final tasks and outcome standards will be produced in computerized formats using the V-TECS DIRECT Software and other appropriate tools.

- The occupational analysis approach will be expanded to identify the basic and related academic skills as well as the occupational skills and the generic "people/personal" skills employers want as identified by ASTD, SCANS, and the Illinois Workplace Readiness Skills Project.

- Tasks and standards will be subjected to at least two independent validation reviews at the national level:

  1. A review by business, industry and the military.
  2. A review by participating states.

OUTCOME II: Building a National Assessment Service --

V-TECS will expand its efforts to develop criterion-referenced test banks for use in customized assessment tools for each occupational title using the previously mentioned nationally validated task list and occupational standards as the base of reference. V-TECS will continue to disseminate test item banks on diskettes in ASCII format for use in V-TECS DIRECT and other MS-DOS test management software as a tool for local program improvement/formative evaluation purposes. V-TECS will work with other organizations such as ACT and NOCTI and the military as well as its own member states to build tests from

existing item banks based on its nationally validated tasks and standards that can then be used for industry skills certification purposes.

- Specialists will develop test specifications for each occupational title so that the appropriate mix and type of items are identified and made available for each task/standard.

- Existing resources from V-TECS states and the military will be used to the maximum extent possible to expedite the process of developing the test item banks for each occupational title.

- Testing specialists will correlate the relevant resources collected from participating states to the appropriate task and standard for each occupational title.

- Gaps in test item banks will be identified and additional items written and validated.

- All items will be reviewed, revised, validated, and field tested with the best items being selected for inclusion in the V-TECS item banks.

At a minimum, all item banks will contain written cognitive items in multiple-choice and matching formats and performance items in checklist, simulation and hands-on formats. All items will be coded so that users can customize assessment vehicles. Appendix B outlines the revised V-TECS process which incorporates these changes in concepts.

What Is the Point?

The key point is that V-TECS, MAVCC, and NOCTI as well as several of the states have been developing business and industry skill standards and measures for over two decades. The problem is they have been doing it in isolation on shoestring budgets. In a recent office of Technology Assessment, Congress of the United States report titled, "Test and Assessment in Vocational Education," Dr. John Wirt made the following observation:

> In the state survey conducted by OTA, described in Chapter 3, state personnel frequently reported that substantial efforts are devoted to adapting, redeveloping, and/or expanding the competency lists and testing resource produced by V-TECS. The V-TECS materials are used in various ways in these efforts, along with competency lists and competency tests (or test items) from many other sources. The reason commonly given as to why these efforts to adapt and revise materials obtained from elsewhere are necessary is that neither the V-TECS materials nor the materials available from other sources adequately reflect the priorities among different areas of knowledge and skills that are most important in the state or local program area.

How much genuine need exists for this reinvention and adaption of materials developed elsewhere and how much of it is unnecessary duplication of effort is impossible to say from the data available to OTA. Local priorities among different areas of knowledge and skill undoubtedly differ from state and notional priorities, and processes of reinvention have frequently been found to be essential for the through implementation of innovations. "To understand is to invent" is perhaps the clearest way of expressing this frequent finding in studies of implementation. On the other hand, questions can be raised about the consequences of this process of reinvention for the comparability of assessment results from place to place and just how necessary and useful it is.

The main conclusion, though, is that the influence of the products of these three vendors of vocational tests on testing and assessment practices in vocational education is limited, at least in relation to all states and all students enrolled in vocational education. V-TECS appears to have the greatest influence through its deliberate strategy of modeling good competency testing and assessment practices for states and local programs to follow, and providing them with competency lists and test item banks to be used as resource in developing their own programs of testing and assessment. However, only 23 states are members of the V-TECS consortium and test item banks are available for only 35 of the over 200 occupational areas in which competency lists are available.

V-TECS sells its testing materials to any state or anyone who wishes to buy them. While NOCTI as an organization has many other clients and customers for its testing products, the number of students currently taking their SOCAT test is very limited. Work Keys is too new to now how extensive its impact will actually be, but at least two states (Ohio and Tennessee) have adopted portions of it for statewide use and many more are considering its use.

It is also important to point out that some individual states, such as Oklahoma, which has an extensive program of test development and distribution, also provide competency tests and resources for testing to other states in various ways. The three vendors described here are the most visible vendors of testing resources in vocational education but not necessarily the only such source.

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The truth is that the work of V-TECS as well as that of most states are among the best kept secrets in the United States, especially since their application is far beyond the traditional boundaries of vocational and technical education. What V-TECS and other vocational-technical education organizations do is just as useable in school to work transition, youth apprenticeship, JTPA, JOBS, state economic development programs, and, yes, even in business and industry; yet, no one has been able to do everything that is needed because the job is simply too big. Consequently, before you decide to spend millions to develop or create a new industry skills identification certification system, think about maximizing on what the taxpayers have already paid for. There is another recent study that provide great detail

regarding what has already been done in this country that ought to be seriously looked at or at least consulted in the process. This study was done by the Institute of Education Leadership, Inc. for the Department of Education. It was produced in four volumes:

Volume I: Overview of Education and Industry Skill Standards System in the United State and Other Countries.

Volume II: Education Driven Skill Standards Skill Systems in the United States.

Volume III: Industry Driven Skill Standards System in the United States

Volume IV: Overview of Skill Standards System in Selected Countries.

Finally, the Department of Education and Department of Labor should look more closely at what the U.S. Army, U. S. Navy, U.S. Air Force, and U.S. Marine Corps have to offer the national standards and certification process since they are the best in the world in the performance based training and assessment arena. A couple of days at the Occupational Analysis Center, U.S. Air Force Training Command, Randolph Air Force Base, Texas, will teach you much more about this concept than six weeks in Australia, Europe, or Japan will.

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